Report No.

FHWA MT 7926-02

MONTANA DEPARTMENT OF HIGHWAYS

RESEARCH PROJECT

PREDICTING MOISTURE INDUCED DAMAGE TO ASPHALT CONCRETE DESIGN MIXES

Investigative work by:

Richard D. Gustovich

Written by:

Bradley Bruce

June 30, 1978

Report No.

FHWA MT 7926-02

MONTANA DEPARTMENT OF HIGHWAYS

RESEARCH PROJECT

PREDICTING MOISTURE INDUCED DAMAGE TO ASPHALT CONCRETE DESIGN MIXES

Investigative work by:

Richard D. Gustovich

Written by:

Bradley Bruce

June 30, 1978

Title: Predicting Moisture-Induced Damage to Asphalt Concrete Design Mixes ("E" Modulus)

Implementation of Research

Investigative Work: Richard D. Gustovich

Written By: Bradley Bruce
State of Montana
Department of Highways
Materials Bureau
Helena, Montana 59601

June 1978

Research Project 7926-02

This project was carried out in cooperation with the U. S. Department of Transportation, Federal Highway Administration.

The opinions, findings, and conclusions expressed in this report are those of the author and not necessarily those of the Montana Department of Highways or the Federal Highway Administration. The intent of this report was to develop tests that were sensitive to moisture susceptibility. A statement that a test is not effective for this purpose should not be construed as discounting the validity of the test for its original application.

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FHWA MT-7926-02		

4. Title and Subtitle
Predicting Moisture Induced Damage to Asphalt Concrete Design Mixes (E-Modulus) Implementation of Research

5. Report Date
June 1978

6. Performing Organization Code

7. Author(s)
Bradley J. Bruce

8. Performing Organization Report No.

9. Performing Organization Name and Address
Montana Department of Highways
Materials Bureau, Highway Complex, (E. of Helena)
Helena, Montana 59601

10. Work Unit No.

11. Contract or Grant No.

12. Sponsoring Agency Name and Address
U.S. Department of Transportation
Federal Highway Administration
Offices of Research & Development
Washington, D. C. 20590

13. Type of Report and Period Covered
Final Report
1974-1978

14. Sponsoring Agency Code

15. Supplementary Notes
Technical Monitor, Robert T. Rask
Testing and Data Calculation by Richard D. Gustovich

16. Abstract
Many asphalt, aggregate, mineral filler and chemical additive combinations were tested for the correlation of the "E" Modulus Test with visual assessment of the condition of the asphalt aggregate specimen and the results of other test methods including Marshall Method, Resilient Modulus, Immersion Compression and Maximum Tensile Stress. Specimens used in conventional tests were treated in the manner prescribed by the method. Specimens for "E" Modulus, Resilient Modulus and Maximum Tensile Stress were tested both before and after subjecting them to severe artificial conditions that were conceived as comparable to several years of natural exposure to the elements.

"E" Modulus was judged to be too inconsistent with other variables to be used as an acceptable criteria.

The data suggests that Maximum Tensile Stress and Resilient Modulus tests would be valid tools for the evaluation of asphalt aggregate susceptibility to moisture damage. Immersion Compression data could be interpreted to provide information about stripping resistance and could serve to aid in the fabrication of mixes with reduced moisture susceptibility. The Marshall Method Testing provided inconsistent indications of moisture susceptibility using either flow or stability values.

17. Key Words	18. Distribution Statement
Moisture Susceptibility Response "E" Modulus, Maximum Tensile Stress, Moisture Susceptibility, Resilient Modulus, Immersion Compression, Marshall Method	No restrictions. This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified		

Form DOT F 1700.7 (8-69)

Acknowledgements

Mr. Gustovich was the principal investigator for the greatest span of this project. He conducted his investigation carefully and documented his efforts completely. As a result, his transfer from this investigation did not interrupt its completion. The author is grateful to Mr. Gustovich for his essential investigative work and the innovative testing comparisons that he devised.

Appreciation is expressed to Mr. Robert T. Rask, the Technical Monitor. His critical review of this report aided immensely in its attainment of this final form.

Appreciation is also extended to the other members of the Materials Bureau who assisted in the research effort.

The assistance of Dr. Lottman who furnished plans for fabricating the equipment and suggested operational guide-lines is acknowledged.

The interest of Mr. Ed Miller was responsible for the inception of this project and his contribution is also acknowledged.

TABLE OF CONTENTS

ILLUSTRATIONS

Introduction

The Montana Department of Highways has occasionally been responsible for the construction of asphaltic roadways that stripped to some degree. Stripping is defined as the loss by asphalt and aggregate of all or part of the bond that exists between them. Because it usually occurs in pavements after a number of years have elapsed, it may be obscured by the natural wearing of the roadway. It is a problem for which we have had no solution because the bonds that decay do so with time. The propensity to strip has not been a reliably detectable quality with our present mix design program.

In 1975, Dr. Robert Lottman reported that a "E" Modulus device developed by Mr. Larry Wolfe, under a Phillips Petroleum Fellowship, could be used to detect moisture damage to asphaltic concrete specimens. Doctor Lottman also presented procedures designed to produce weathering and moisture deterioration equivalent to many years of natural service for asphaltic concrete.

Impressed by the device's potential for evaluating asphaltic concrete moisture susceptibility, the Montana Department of Highways fabricated the "E" Modulus equipment. We thought that while testing the "E" Modulus device's potential, Immersion Compression Testing, Marshall Method Testing, and Maximum Tensile Stress Testing could also be evaluated for their capability of detecting or measuring moisture related damage. In July of 1977, we obtained Resilient Modulus equipment in connection with a related project. Immediately Resilient Modulus Testing was added to the tests to be evaluated during this project.

It was decided that the fabrication of a variety of specimen sets of different aggregates, asphalts, fillers and additives would present the maximum opportunity to test the flexibility of the equipment. If conditions could be found under which any test was not sensitive to moisture damage, then the results of that test could not be relied upon in selecting non-susceptible aggregate combinations for mix designs. Conversely, if the tests did reliably detect moisture susceptibility or damage, we would consider adding them to our mix design program.

Samples were fabricated according to the job mix design and tested for their moisture susceptibility with each of the tests to be evaluated. To obtain an asphaltic mixture with changed moisture susceptibility, the initial mix design was altered and other groups of specimens were fabricated. Changes that were tried included, reducing the - 200M aggregate percentage to 0% or increasing it to 17.3% of the total aggregate, adding fly ash, cement, or hydrated lime, and varying the asphaltic content between 5.5% and 8.5%.

We anticipated that if we obtained the results of several different tests with one asphaltic cement, that changing the asphalt-aggregate mix and performing another set of test comparisons would produce a proportional change of data with all of the related tests. Tests that were not repeatable or related to moisture susceptibility would produce irregular data.

Unconventional asphaltic mixes with excessive -200M or decreased asphalt content were fabricated to establish the minimum test properties of any specimens. These mixes were deliberately made with an "unbalanced" gradation or with incorrect asphalt content in order to produce mixes that were moisture susceptible. It was thought that specimens of these mixes would dramatically deteriorate because of their exceptional moisture susceptibility and provide the extreme negative positions of the testing. When some of these specimens, intended to establish minimums exhibited better test properties than the original mix, it was concluded that sufficient knowledge to deliberately design a mix with maximum moisture susceptibility was lacking.

Our alternative approach to determining the low points and the relationship of different properties of a given asphalt aggregate combination was to find a shared property common to all of the specimens. We reasoned that any test could be gauged against this property and against other tests.

Since the limiting or elimination of future stripping is our ultimate objective, the examination of each mix after it had aged in the field, would provide definite evidence of how well each asphalt aggregate combination had resisted moisture damage. Comparison of the severity of the stripping of each aged asphalt to the response of each test would develop correlations of related tests. It would require several years to obtain each evaluation using this procedure and this is not within schedule limitations of this project.

A test precedure that predictably accelerated deterioration of the asphalt aggregate mixes to a condition equivalent to several years of exposure to weathering would allow us to examine "aged" asphalts immediately. We referred to the work of Dr. Lottman and found that he had developed artificial processes which sythesized the effects of many years of natural exposure for asphaltic concretes. In the NCHRP Final Report, 4-8(3), he compared several asphalt cements which had been artificially aged with duplicate mixes which had undergone long term exposure to weathering in the field. The condition of the artificially and the naturally aged asphalt concrete was similar enough to validate the artificial process for accelerated aging of asphaltic concrete. The "duplicate" of the naturally aged asphaltic concrete could be tested and examined to determine the future condition of a particular asphalt aggregate mixture.

Specimens that were "aged" were either saturated or conditioned. Specimens that were not aged were "dry". These processes are an integral part of the "E" Modulus Testing, Resilient Modulus Testing, Maximum Tensile Stress Testing, and for making observations on stripping.*

Dry -refers to a specimen that is prepared for testing by dessicating it to dryness and cooling it to 55°F in an air bath at that temperature. It requires approximately 4 hours in the air bath for the sample temperature to be reduced to 55°F. When the sample is removed from the air bath it must be tested within five minutes (before the temperature of the specimen increases). If testing is to be delayed after the dessication process is completed, the sample should be wrapped with plastic and stored in a refrigerator.

Saturated - refers to a specimen that is treated by submerging it in distilled water at 73°F on a porous plate in a sealed chamber. Air is pumped from the chamber until a vacuum of 25-26 inches of mercury is produced. This vacuum is maintained for 30 minutes and then slowly dissipated, but the specimen is left in the water for 30 additional minutes. The specimen is then withdrawn, wrapped in plastic, taped and sealed in a plastic bag with ten cubic centimeters of free water added to preserve the saturation. If testing is to be delayed, the sample is stored in a refrigerator until four hours prior to testing. At that time, the specimen is submerged in a 55°F water bath and allowed to equalize with this environment for testing. Specimens removed from the 55°F bath are to be tested within 5 minutes while they are still uniformly chilled.

*Tests are described in detail starting on page 6.

Conditioned - refers to a specimen that is further treated after saturation and wrapping. Samples are placed in a freezer adjusted to $0^{O}F$. After 15 hours the specimen is removed from the freezer and placed in a $140^{O}F$ water bath for 5-10 minutes to thaw it enough to remove the wrapping. The wrapping is removed and the specimen is returned to the $140^{O}F$ water bath. After 24 hours the specimen is removed from the bath and placed in distilled water at room temperature. After this the specimen is processed in the same manner as the saturated specimen.

When the adhesion bonding of asphalt and aggregate is reduced from moisture induced damage, it is possible to see uncoated aggregate on the internal surfaces of samples that have failed as a result of Tensile Stresses. The extent of the coating loss (stripping) is a visible indication of the severity of the moisture damage. Since the bonding of asphalt and aggregate are responsible for the mechanical properties of the specimen, stripping and the response of tests, sensitive to bonding, are related.

The stripping observed for each specimen was numerically expressed to provide the basis for a uniform rating system. A one rating was assigned to an asphalt aggregate combination that did not strip visibly after it was aged. A two rating was assigned to a combination that stripped only on the small aggregate. A three rating was a mix that stripped on some of the larger aggregate particles and a four rating was given to an asphalt combination that stripped severely from all sizes of aggregate particles.

All of the data of each test that was evaluated was compared to the physical stripping of its aged counterpart. We thought that acceptable tests for moisture damage of asphaltic materials would predict a propensity to strip and provide numerical data that expressed the combined influences of moisture, and aging. They would do this by exhibiting data changes that were proportional to the observed stripping. Data from one test that changed in proportion to the amount of stripping would also be proportional to any other test whose data was proportional to the same stripping.

An aid to visualizing the degrees of stripping, pictures of asphalt specimens with stripping rated 1 through 4 are shown in Figure 1.

4. Severe Stripping

3. Moderate Stripping

2. Minor Stripping

1. No Stripping

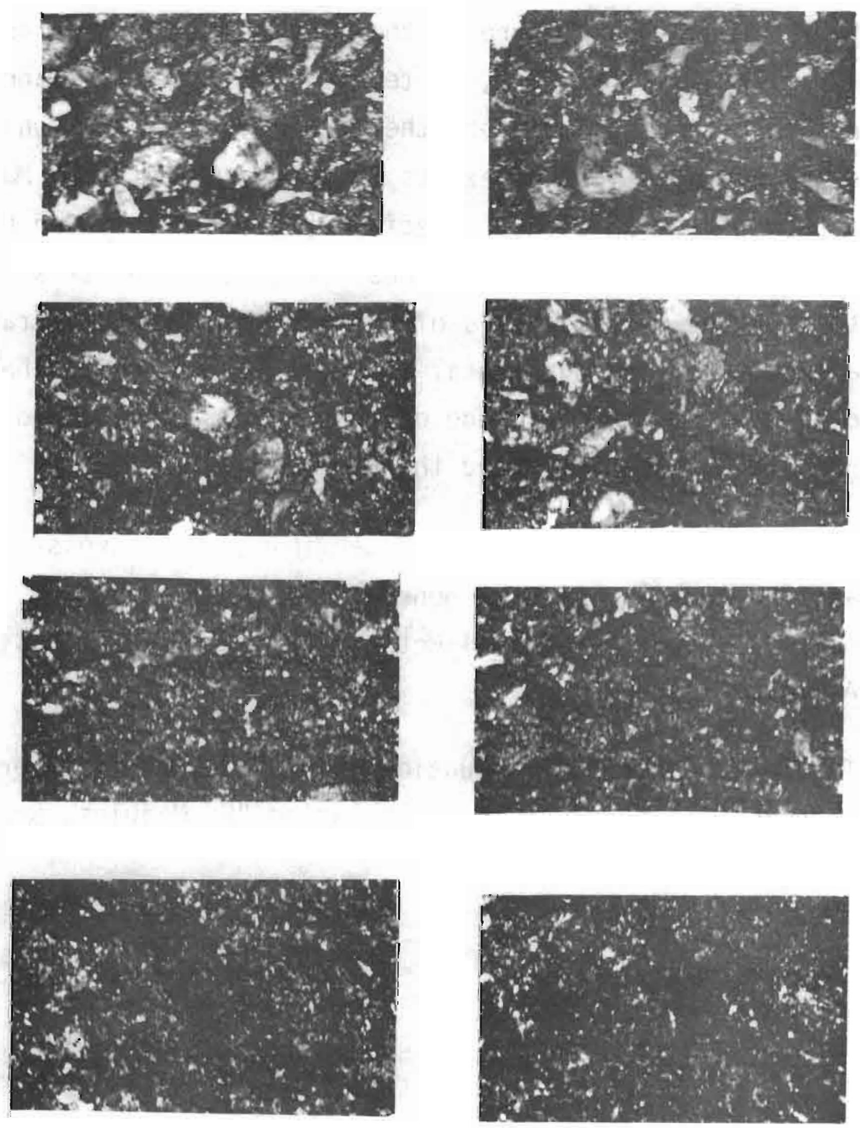


Figure I

Tests

The tests that were conducted on the asphalt samples are reviewed in this section. A knowledge of these tests is fundamental to understanding the significance of the data.

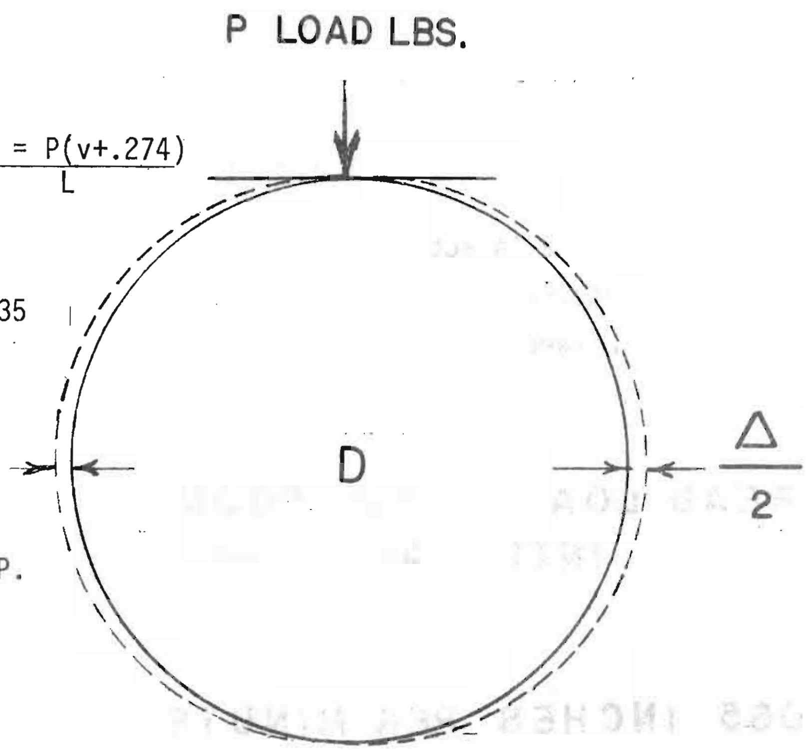
E-Modulus

"E" Modulus is a measure of the elastic response of asphalt cement, a semi-plastic material, to tensile loading. The magnitude of this response is dependent upon the strength and the amount of asphalt-aggregate bonding that exists in the specimen. "E" Modulus data is obtained from an asphalt specimen (thin disc) loaded between two horizontal compression plattens, (Fig. 2). The tensile forces induced through the vertical axis of the specimen produce strains that are at a maximum on the horizontal axis of the specimen. These strains are dependent on the magnitude of the load imposed, the diameter and thickness of the specimen, and the material.

The basis of mathematically determining this stress-strain relationship and the tensile stresses generated is discussed by R. J. Schmidt in a paper titled; A Practical Method of Measuring the Resilient Modulus of Asphalt Treated Mixes.

The tensile stiffness equation presented in this paper expresses the principal factors used in calculating "E" Modulus, Resilient Modulus and Maximum Tensile Stress.

Tensile stiffness equation $TSM = \frac{P(v+.274)}{L}$



P = load - pounds

v = Poissons ratio - use of 0.35

t = thickness of disc - inches

Δ = the remainder when the diameter (D) measured before the application of load (P) is subtracted from the same D measured during the application of P.

L = thickness of disc

Fig. 2

The equation formulates a stress divided by strain and area relationship with units of lbs., inches and square inches. Metric conversion is possible by multiplying by $\frac{1\text{Kg}}{2.2\text{ lb.}}$ and by $\frac{(2.54\text{cm})^2}{(\text{ in. })}$. The conversion factor becomes $\frac{\text{lb.}}{\text{in.}^2} \times 2.93 = \text{Kg/cm}^2$.

In Mr. Schmidt's work, he found assigning an average value of .35 to Poissons Ratio yielded Modulus values substantially the same as when Poissons Ratio was determined more precisely.

The equation is modified when it is necessary to account for the flattening of the top and the bottom of the specimen under a sustained compressive load. Flattened surfaces assume a portion of the vertical load and produce less tensile stress than if a true round disc configuration was maintained throughout the loading cycle. This limiting factor was derived for the NCHRP 4-8(3) final report. With the flattening involved the tensile stiffness modulus equation is:

$$TSM = \frac{S_{10} \times P\ max}{10{,}000 \times L}$$

"E" Modulus data is actually taken by recording the vertical force at 10 second intervals that results when the asphalt specimen is loaded vertically between horizontal compression plattens moving at .065 inches per minute.

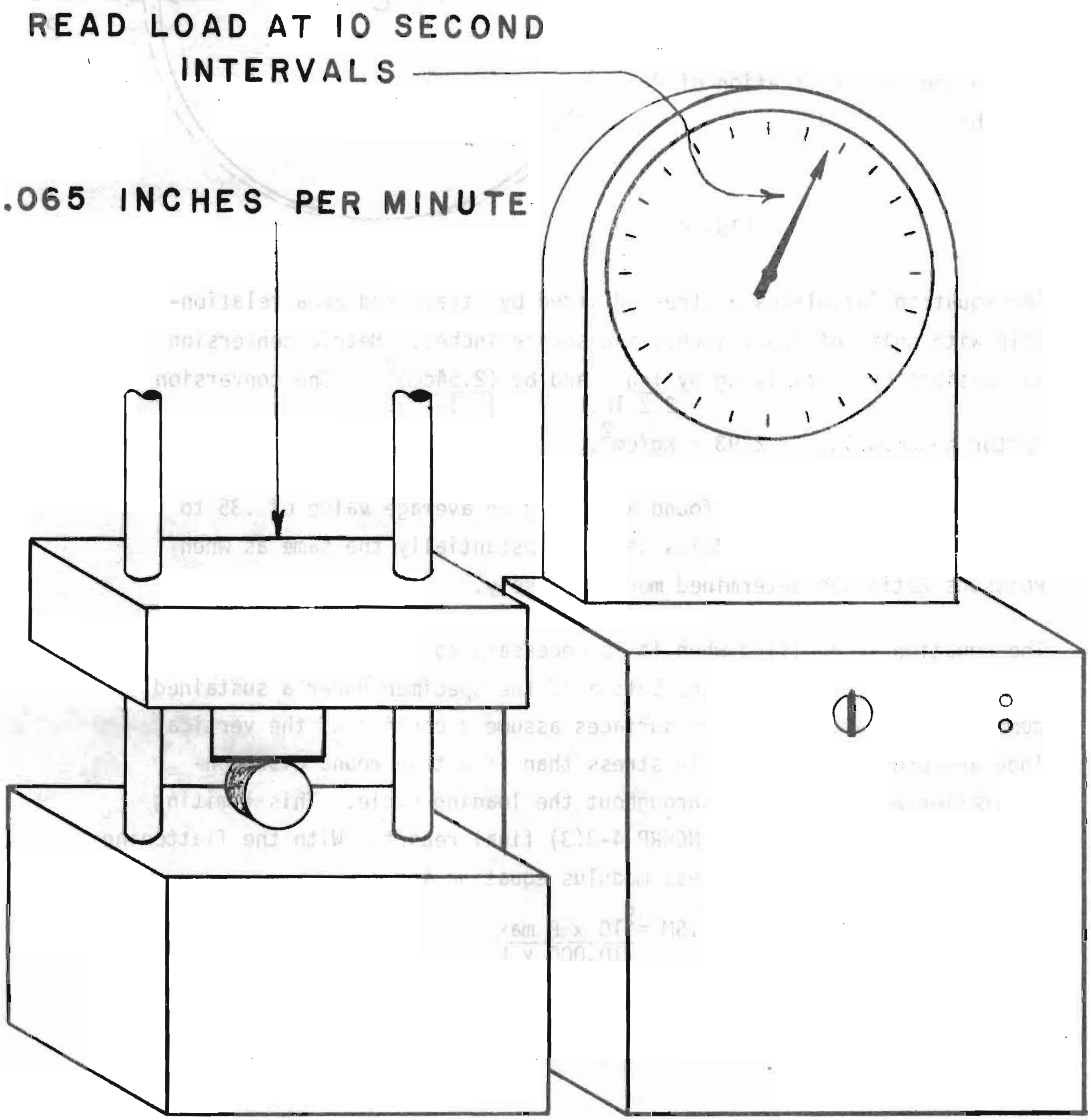


Fig. 3

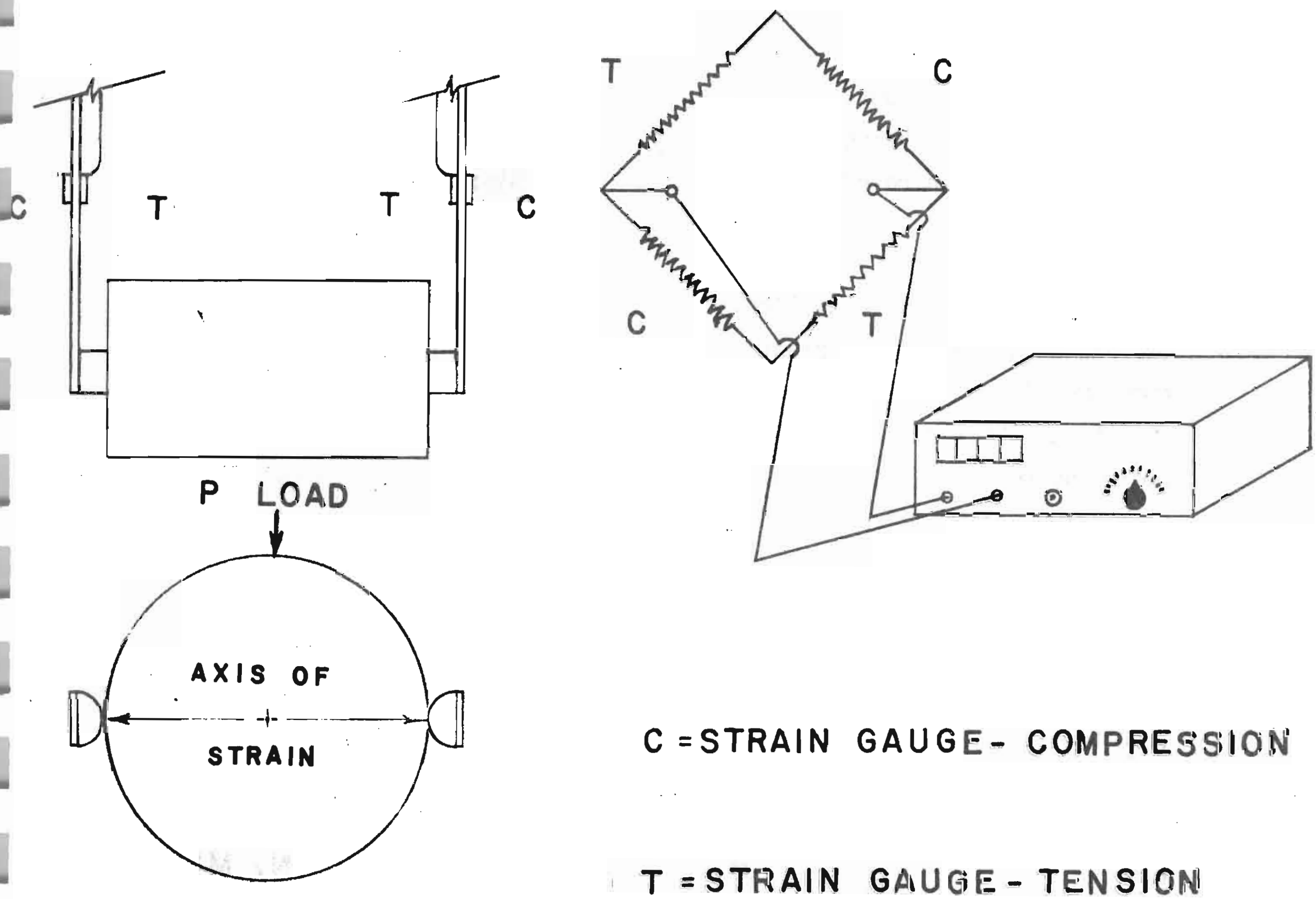


Fig. 4

Simultaneously, the deformation of the specimen is measured on the horizontal axis of the diameter. Deformations are obtained through an assembly of two thin metal strips which bracket the specimen and exert slight inward pressure. Strain gauges are fixed to each side of these arms and when the asphalt specimen deforms the strips are flexed. This exerts tension or compression on the gauges which are wired into a wheatstone bridge circuit. This circuit generates relatively large voltage imbalances for small changes of the strain gauge resistance. The output of the circuit is adjusted with a variable resistor so that one thousandth of an inch deflection generates one hundredth of a volt. This is read on a digital volt meter. This deflection and the simultaneous load developed by the press plotted are injected into the tensile stiffness equation to yield the tensile stiffness modulus.

When data for the "E" Modulus test is taken at timed intervals with the compressive plattens closing at a constant speed, a series of tensile stiffness moduli may be generated. If these moduli are plotted on 3 cycle log paper with time scaled on the horizontal axis a straight line may be approximated through the data. Extending this line to the vertical axis of the graph we locate the tensile stiffness modulus at time zero. At this point no load has been imposed, no plastic deformation has occurred. The tensile stiffness modulus at this point is obtained from an underformed specimen. By definition, the load response of an underformed material must be an elastic response so the tensile stiffness modulus at time 0 is the elastic or "E" Modulus of the material. In this example, it is 2.1×10^4 psi.

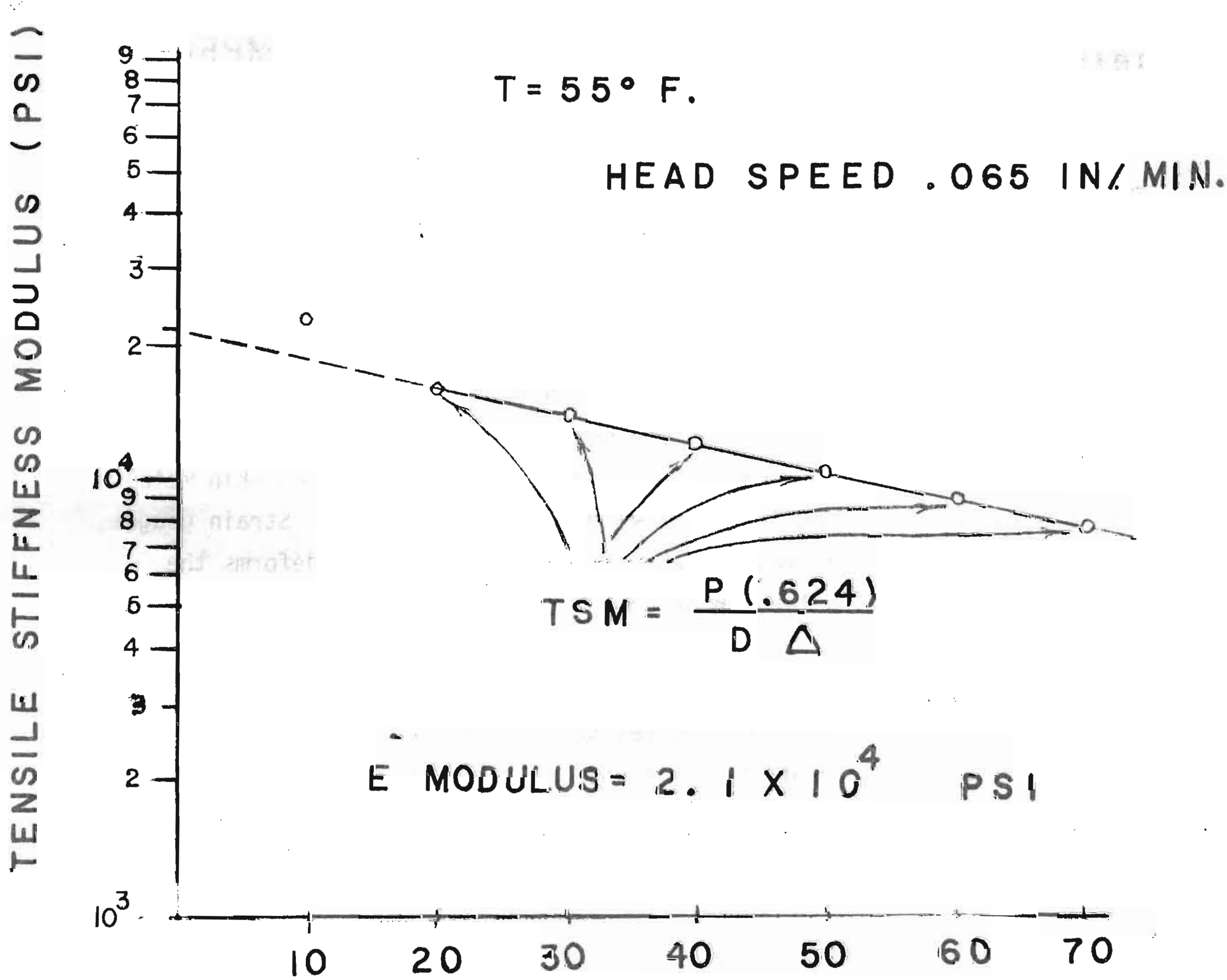


Fig. 5

Maximum Tensile Stress Testing

This test is a mathematical manipulation of the "E" Modulus Loading System. When the asphalt specimen is loaded between the compression plattens the induced tensile forces through the vertical axis are at a maximum when the bond of asphalt and aggregate fail and the specimen ruptures. The developed stresses are limited by flattening but related to the thickness of the disc and the load sustained at the time of failure.

The formula for maximum tensile stress is: $St = \frac{S_{10} \times P\ max}{10{,}000 \times L}$

St = maximum tensile stress

P = maximum load

S_{10} = function of flattening explained under "E" Modulus

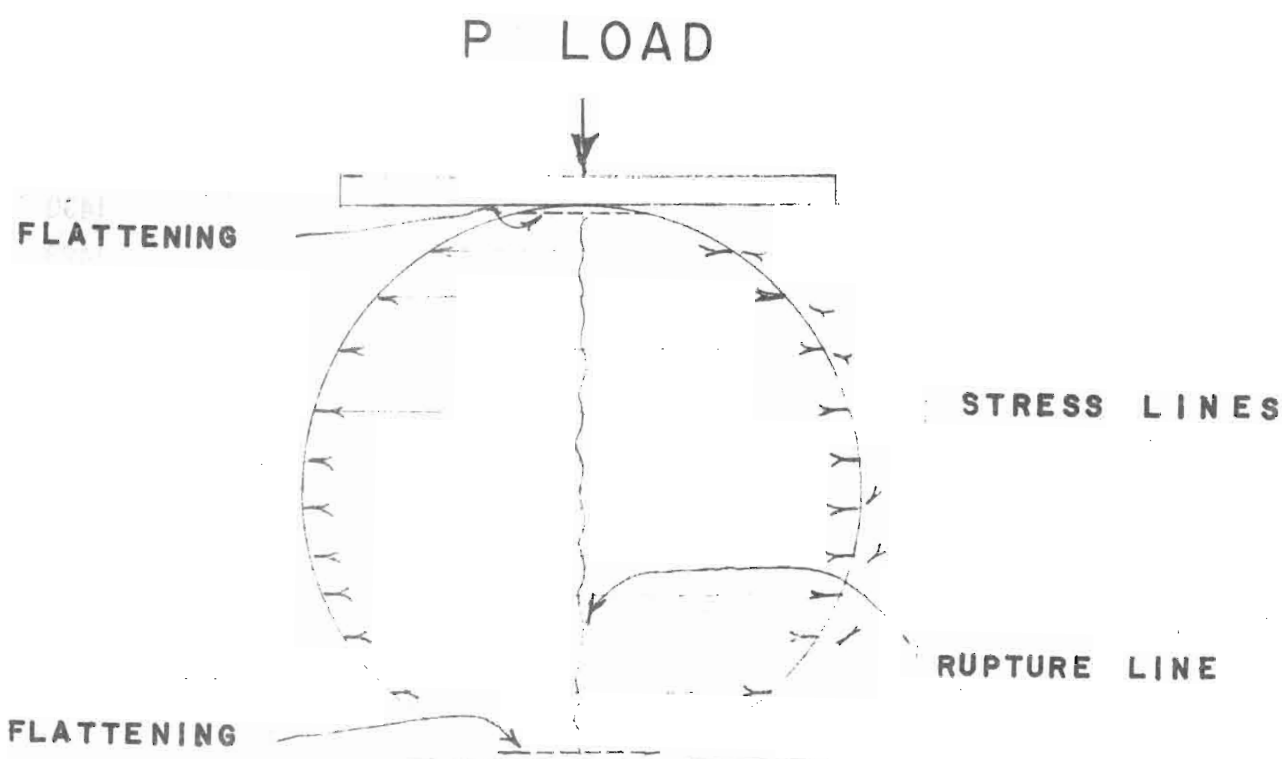


Fig. 6

The limiting factor of tensile stress;

$^{S}10$ is equal to 1591 + 437a - 1889a2 + 2854a3 - 247a4 - 885a5 $\pm$

a = flattening expressed in inches, but less than one inch.

$^{S}10$ was calculated for flattening 0< a > 1 inch in hundredths of an inch.

A list of $^{S}10$ function stress limitation is shown.

Flattening Inches	$^{S}10$ PSI	Flattening Inches	$^{S}10$ PSI	Flattening Inches	$^{S}10$ PSI
.40	1590	.60	1538	.80	1470
.41	1590	.61	1534	.81	1466
.42	1588	.62	1531	.82	1462
.43	1585	.63	1528	.83	1458
.44	1582	.64	1524	.84	1455
.45	1580	.65	1521	.85	1452
.46	1578	.66	1518	.86	1448
.47	1576	.67	1515	.87	1444
.48	1574	.68	1512	.88	1440
.49	1572	.69	1508	.89	1436
.50	1568	.70	1504	.90	1433
.51	1564	.71	1500	.91	1430
.52	1562	.72	1498	.92	1428
.53	1558	.73	1494	.93	1424
.54	1556	.74	1491	.94	1421
.55	1552	.75	1487	.95	1418
.56	1550	.76	1484	.96	1416
.57	1546	.77	1480	.97	1413
.58	1544	.78	1476	.98	1410
.59	1540	.79	1473	.99	1408
				.100	1404

Fig. 7

These figures are used in the equation for computing the tensile stiffness modulus, $TSM = \frac{P(v + .274)}{L}$. Since the deformation response of the specimen tested is from a pulse load, plastic deformation does not have time to occur. Only one point is needed to calculate the Resilient Modulus. Mutiple tests of the same specimen are possible without the specimens being deformed or changed by the test itself. Ratios of Resilient Modulus of specimens tested dry, saturated, and conditioned were calculated and compared with the other test responses.

Resilient Modulus Test

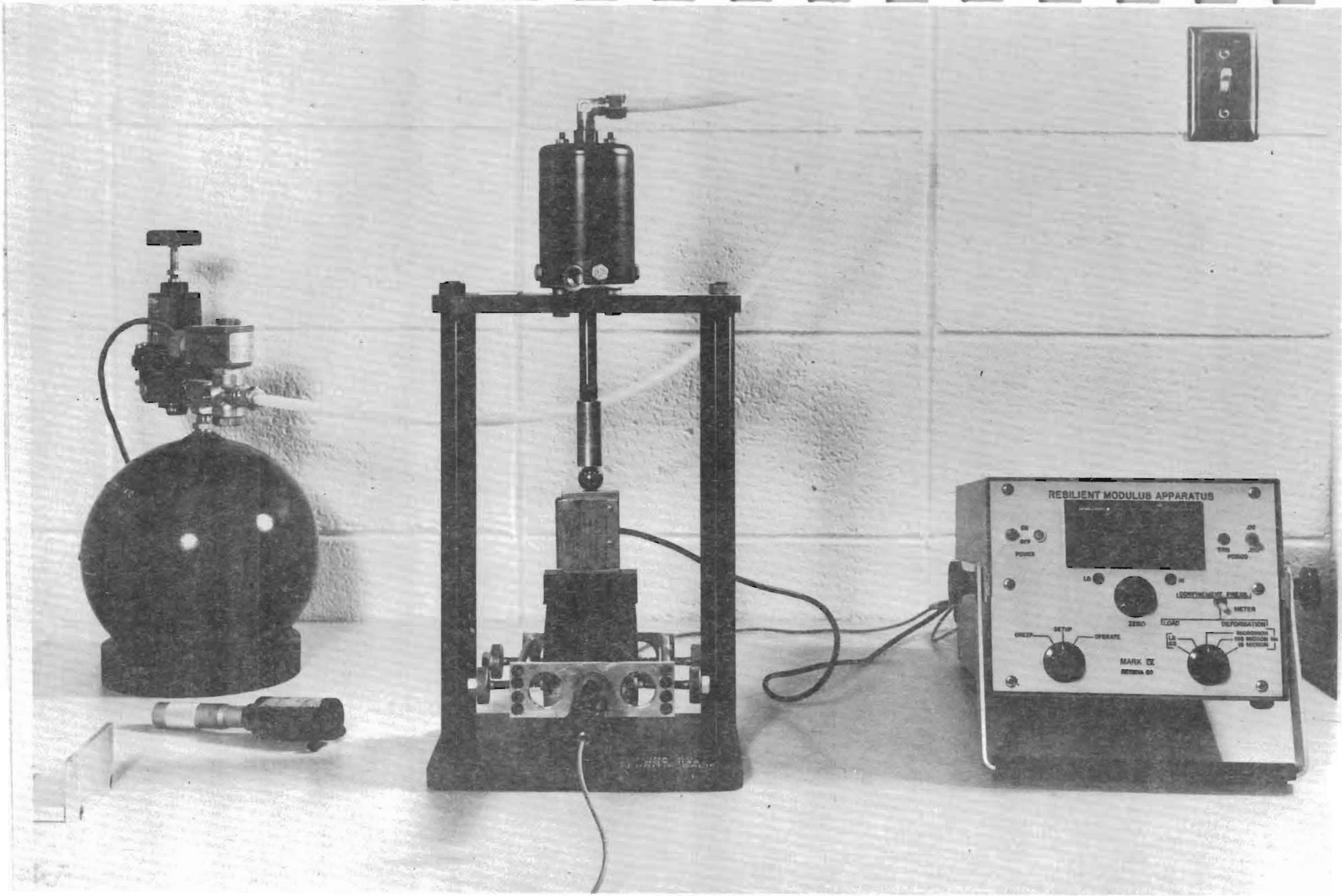
The Resilient Modulus Test was performed on only part of the specimen groups as the necessary apparatus was acquired after this project was initiated. The test was performed on the same dry saturated and conditioned specimens as were used for "E" Modulus. The mechanics of the loading and specimen response is similar to that of "E" Modulus but the device is much more sophisticated. (Fig. 8)

The principal components of the test equipment are a regulated air supply, a pneumatic piston with a spherical bearing seat, a calibrated transducer load circuit, two transducers used in obtaining deformation, and the electronics necessary to translate the transducer displacements into micro inches and lbs.

The load is applied to the specimen through an air actuated piston whose ram force is regulated by the input air pressure. (Fig. 9) This force is transmitted through a spherical seat to prevent torque to a pressure transducer bearing on the specimen. This pressure device is monitored to display the load P applied to the top of the asphalt specimen. This load is transmitted as a pulse of .05 or .1 of a second duration which does not permit the specimen time to deform plastically.

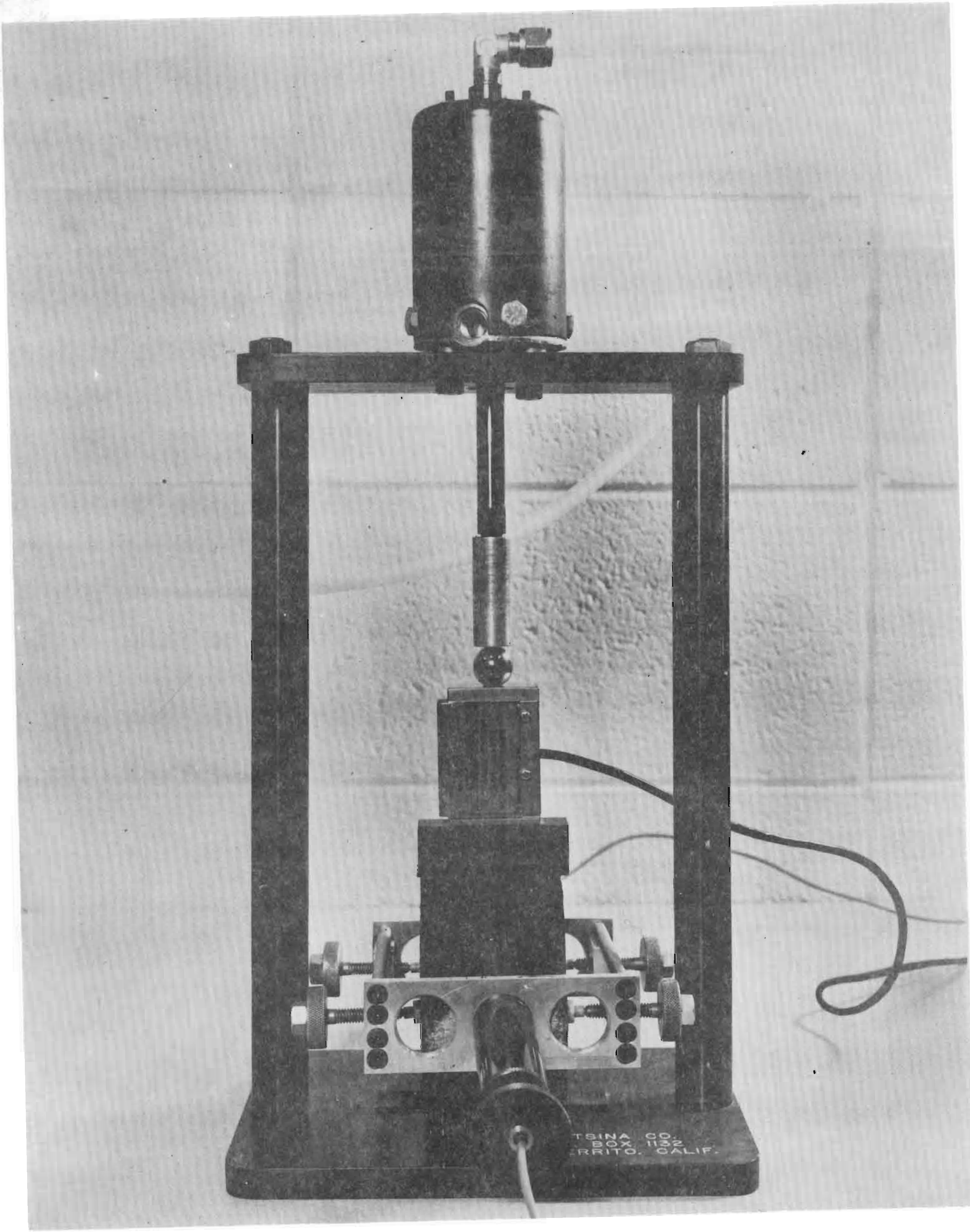
Statham U C-3 transducers are affixed to the specimen using a loose saddle which aligns them perpendicular to the horizontal axis of the specimen where maximum strain occurs. (Fig. 10) The transducers are adjusted to a partially depressed position so that the probes maintain contact with the specimen. During the loading cycle the position of the transducer tips change as the asphalt specimen strains outward from the vertical load. Electronics report the change of the position of the transducer tip and the difference in micro inches of the initial and final position of the transducer on a digital display. (Fig. 11)

Next the load transducer is monitored and the total load imposed through the pressure transducer is displayed.



Complete Resilient Modulus Apparatus

Fig. 8



Specimen in load frame   Fig. 9

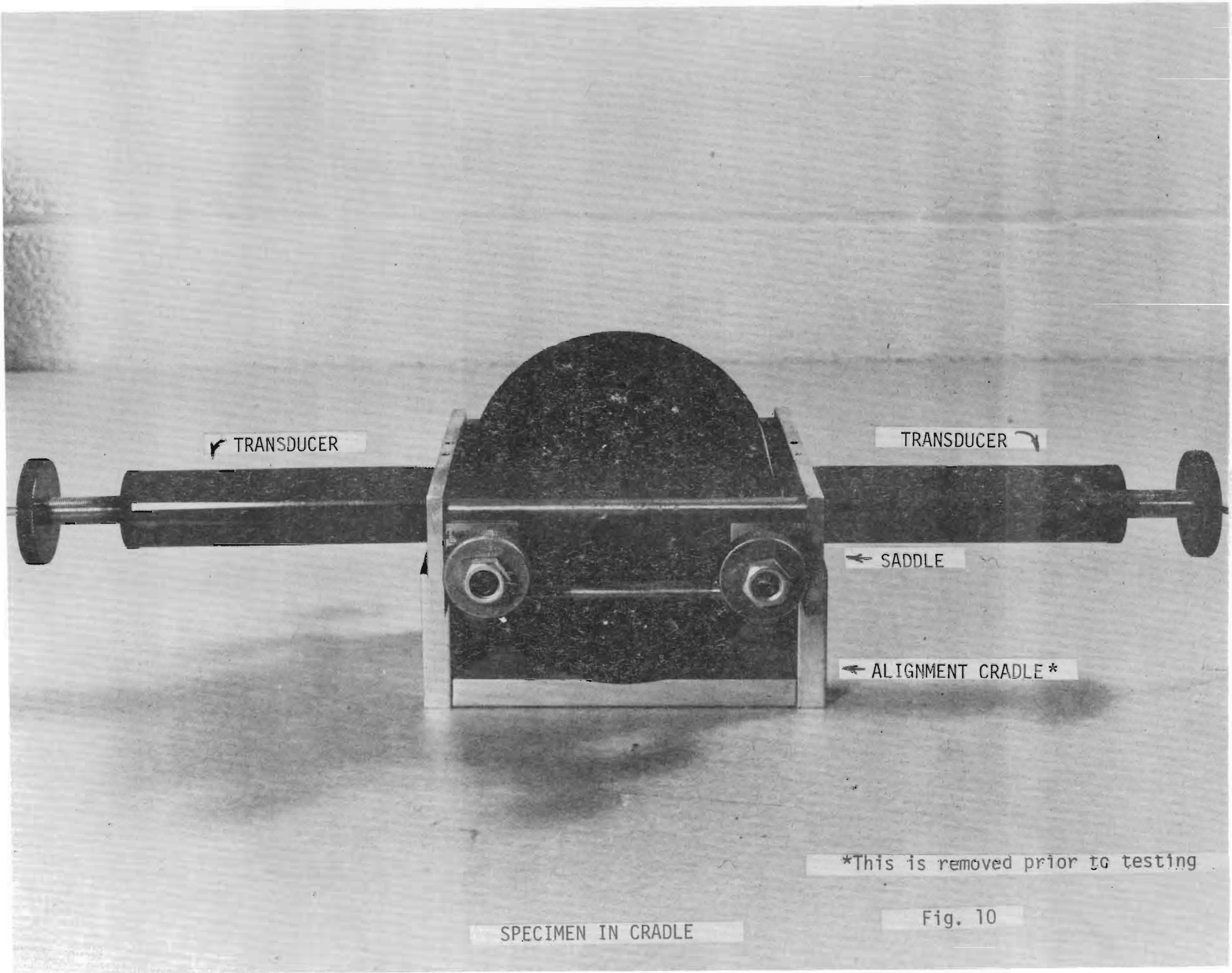
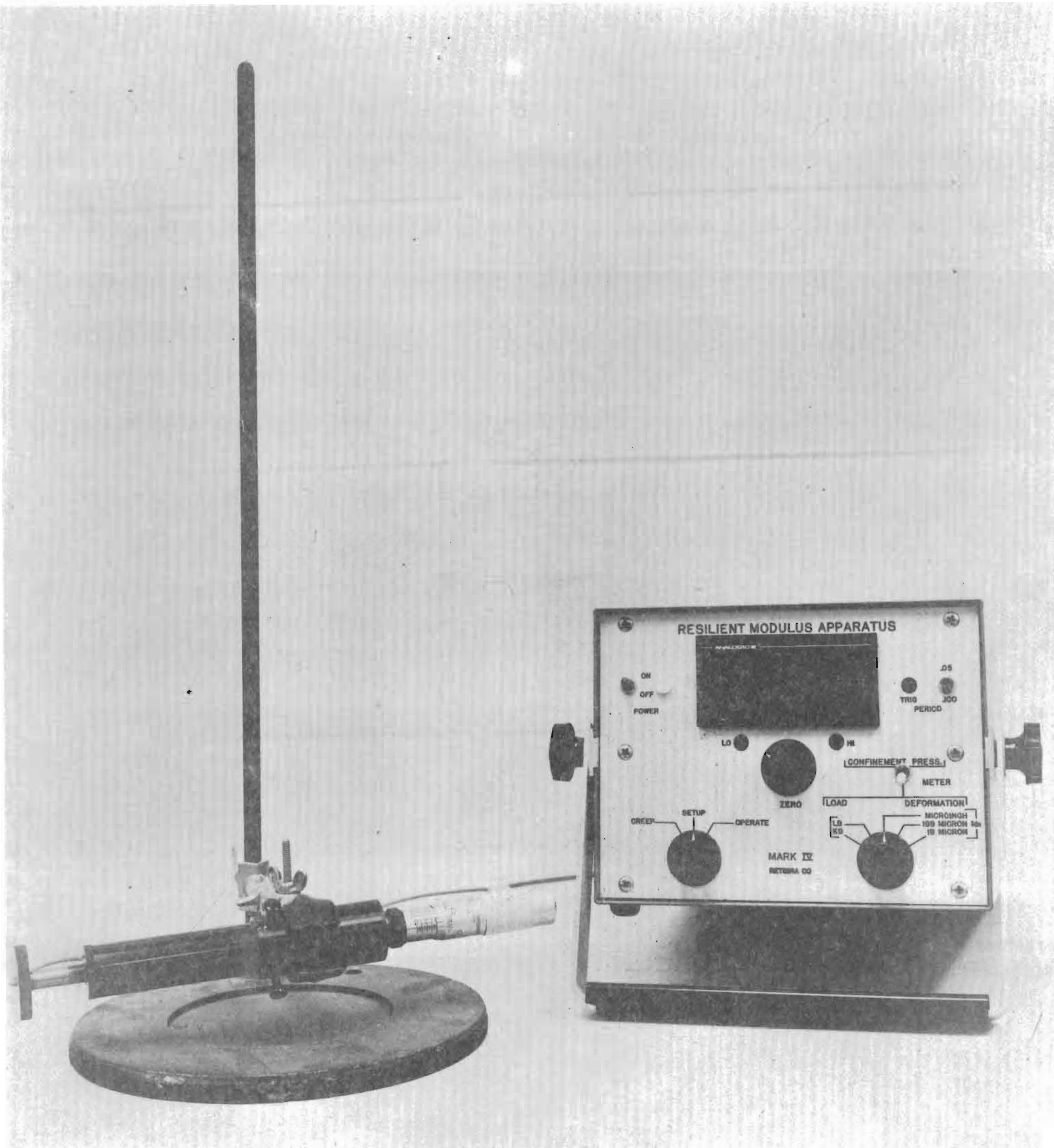


Fig. 10

SPECIMEN IN CRADLE



Resilient Modulus
Face of Instrumentation
Transducer calibration is being checked in picture

Fig. 11

IMMERSION COMPRESSION

Immersion Compression testing which we currently interpret for detecting moisture susceptibility of asphalt aggregate combinations, was compared with the results of other test ratios and with the observed stripping.

Immersion Compression testing conducted according to AASHTO T-165 (Effect of Water on Cohesion of Compacted Bituminous Mixtures), and AASHTO T-167 (Compressive Strength of Bituminous Mixtures) are nationally standardized procedures. They are not described within this report. We compare wet specimen strength to dry specimen strength and calculate the ratio. This factor is used in developing asphalt-aggregate mix designs.

MARSHALL TESTING

Marshall Testing is routinely performed by our Department according to AASHTO T-245-74 (Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus). This is also a nationally standardized test. For all of the asphalt-aggregate mix designs we considered for this research, we examined Marshall data for some correlation with moisture susceptibility. When practical, we consider attaining at least 1,000 psi stability and a flow of between 8 and 18 as desirable. We will examine Marshall data to see the effect of conforming to these requirements on eliminating the use of moisture susceptible asphalt-aggregate combinations.

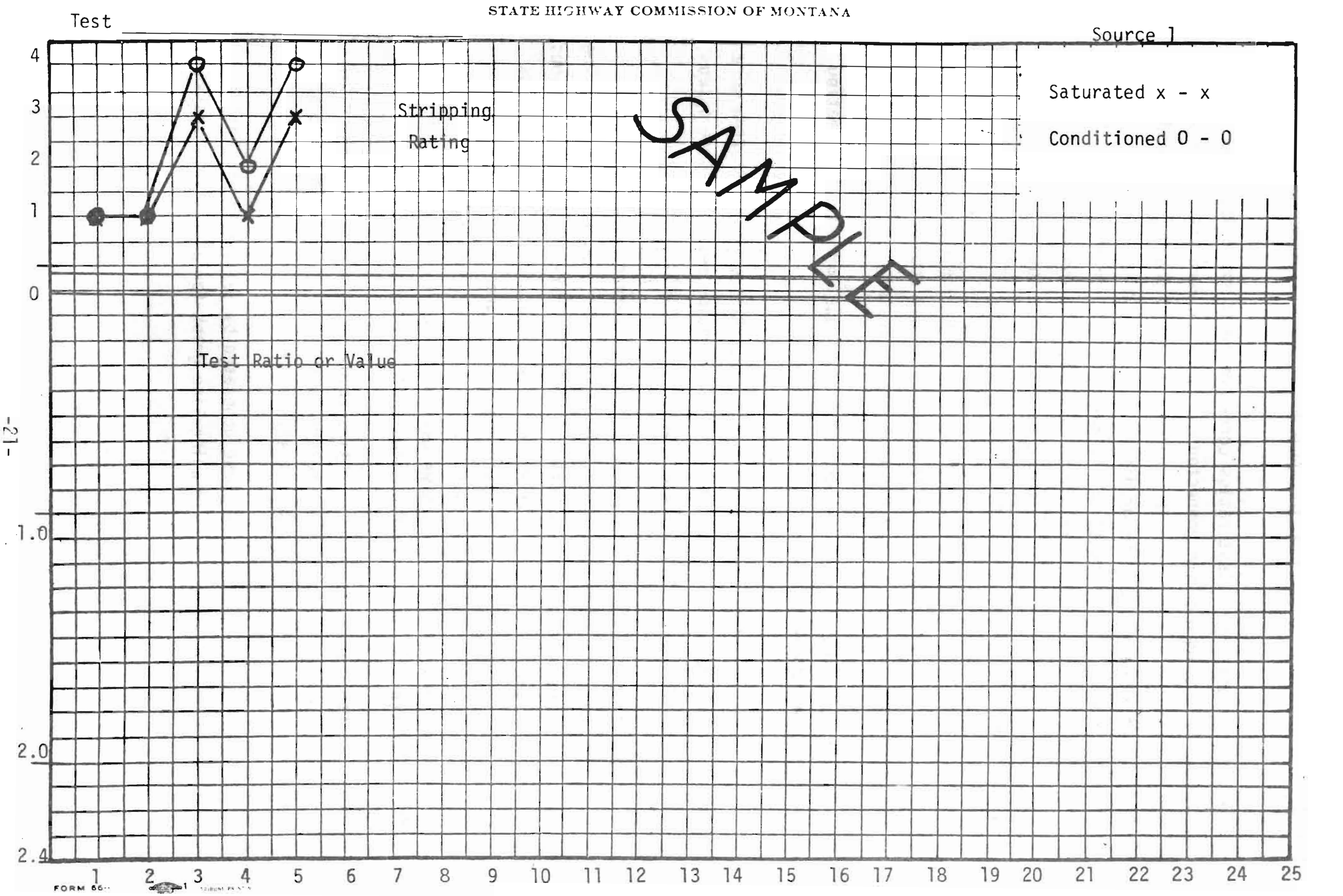
We are evaluating the possibility of detecting and measuring moisture induced damage of asphalt aggregate mixtures. Several different test procedures were performed on samples fabricated from five seperate aggregate sources. Artificial aging techniques and visual examination were used to determine the degree of moisture susceptibility. The response of each test was compared with the susceptibility that was determined for each set of specimens. The validity of a test for ascertaining moisture damage was judged on the linearity of the property changes between specimen sets and the amount of stripping that was observed.

To simplify cross comparisons of data for "E" Modulus, Maximum Tensile Stress and Resilient Modulus which have different magnitudes of stresses, the ratio of the saturated/dry or conditioned/dry specimens of each test was evaluated. The ratio produced by each test was compared to the ratio determined for every test property and to the stripping. We examined data for proportional changes between each test when different asphalt aggregate combinations were tested. We also recorded Marshall Values and Immersion Compression data and compared these values to the amount of stripping observed.

In performing these comparisons we made a set of graphs for every mix tested with each aggregate source used. (Fig. 12) On the upper portion of the Y axis we rated stripping 1, 2, 3, 4 as previously described. On the X axis we plotted the specimen group number. We made six copies of each graph and successively recorded the ratio of "E" Modulus, Resilient Modulus, Immersion Compression, Maximum Tensile Stress, or the test data for Marshall Flow, Marshall Stability, and Wet Immersion Compression PSI on the Y axis. Each test was compared to the common property, the stripping rating, shared by all other specimens in the group and to the ratios developed with the other tests of the specimens in the group. We established that quantatively the ratio did not have to be equal for each of the tests to be sensitive to moisture susceptibility. Tests that were sensitive changed in proportion to each other and to the amount of stripping recorded. The more susceptibile an asphalt aggregate combination was to moisture damage, the lower were the ratios for any tests that responded to moisture damage. When ratios did not reflect the stripping it was found that the test was not sensitive to moisture damage or the normal variation of the test obscured the response of the specimen.

Divide - North

Fig. 12



To aid in realizing if test ratios corresponded to stripping, the points plotted for stripping were connected by a line as were the points determined for the ratio of each test. The shapes of the two graphs were readily identified as being the same or different so stripping could be seen to either correlate the response of the test property or to differ. These line connections were done solely to help identify the similarities of response of different tests. Connected points may not be proportionally related and interpolation between them is not meaningful.

When we observed the stripping and matchedit with the results of the various tests, we found several relationships that occurred with the majority of the aggregate asphalt combination tested.

To assist in understanding the presentation of our work, these repeating factors are listed.

1. The "E" Modulus ratios were erratic. Ratios below .5 often were accompanied by moderate stripping. Ratios below .30 were often encountered when there was severe stripping.

2. Immersion Compression strengths often served as guide for determining asphalt specimens resistance to moisture damage. The interpretation of Immersion Compression data often gave erroneous results, especially if an arbitrary retained strength ratio was used to define an acceptable asphalt aggregate mixture. When used in this manner, Immersion Compression accepted any of the asphalt aggregate combinations we used for trial including those that stripped severely when "aged".

3. Maximum Tensile Stress ratios below .60 characterized material subject to moderate to severe stripping. When ratios were above .80 the aggregate had not stripped.

   The line graph curve shape generated by Tensile Stress ratios corresponds to the stripping line graph for asphalt aggregate combinations.

4. If Resilient Modulus Testing ratios were above .60 for both saturated and conditioned specimens, the materials were not susceptible to moisture induced damage.

Even though these rules were characteristic of most of the asphalt aggregate combinations used, an examination of individual tests related several exceptions. These are significant to the research and can only be developed separately. Individual source development arranges the testing in chronological order and allows for development of the source variation encountered during the testing.

Source No. 1
Divide North Aggregate
Appendix B, Reference Chart 1
Graphs Pages 67-74
Project I-15-2(34)103 U-3
Pit Location SW¼ SW¼ Sec. 16, T-1-S, R-9-W
and SE¼ SE¼ Sec. 17, T-1-S, R-9-W

The first source used in the testing program was initially batched according to the mix design of a current highway project. When these specimens stripped severely from saturation and conditioning,we proceeded on the assumption these aggregates would produce very susceptible mixes with all grading combinations. We thought we were producing specimens that would produce the minimum response of each test that corresponded to a maximum moisture susceptibility. After we had fabricated and tested several sets of specimens with only minor changes from the original design mix, we had encountered moderate or severe damage with only one other set of specimens. We realized that a more organized approach was required and reverted to the procedures of test comparison detailed previously.

The graphs that were used to compare stripping (pages 67-74, appendix B) and the individual test properties serve as a convenient basis for a discussion of the test results. With aggregate number one, no Resilient Modulus data was taken.

Notice that the aggregate asphalt bonding of all groups satisfied a Marshall Stability requirement of 1,000 PSI. Group two, which was very resistant to moisture damage, failed Marshall Flow requirements. The "E" Modulus testing correctly identified groups one and two which were moisture resistant, and groups three and five, which were susceptible to moisture induced damage. It also rejected as very susceptbile the group four aggregate asphalt which showed very little stripping.

The Tensile Stress evaluation of the aggregate number one, almost paralleled the stripping observations.

The Immersion Compression data was so constant that no conclusions may be drawn. All ratios were above .90. Referenced to the initial chart, the PSI of the Immersion Compression specimens that were soaked is higher for the more moisture resistant asphalt aggregate conbinations.

Source No. 2
Teton River-North & South
Reference Chart 2, Appendix B
Graphs Pages 75-81
Project I-15-6(16)308
Pit Location SW¼ SE¼ & SE¼ SW¼, Sec. 11
T-33-N, R-6-W

A second source of aggregate was selected, one considered acceptable but not superior. Fifteen different groups of specimens were fabricated with changes in the percentage of -200M, the use of fillers or additives, and changes in compaction for a few groups.

The -200M aggregate used in the first specimen group was 17.3% of the total aggregate. The performance of this high -200M material (our specification limit is 10%) was so good we made four additional batches with compaction reduced from 100% Marshall density. With compaction reduced to obtain 97-99% Marshall density, the stripping resistance of the high -200M material specimens was poor. This did not pose any difficulties since the mixes we are experimenting with are not intended for field use. We are only concerned with the procedures and methods for detecting moisture susceptibility. The first group of specimens tested did not show stripping. The "E" Modulus, and Immersion Compression ratios indicated this group of specimens would fail. The Maximum Tensile Stress ratio showed the combination was satisfactory and Marshall data yielded an exceptionally high stability.

The prediction of "E" Modulus and Immersion Compression, though not precisely correct, are true if less than Marsahll compaction is obtained. For this reason we were reluctant to condemn either test at this point.

The group 2, 3, 4, 5 and 7 aggregate asphalt combinations all had poor resistance to moisture induced damage. This was predicted by using the "E" Modulus response for all of the groups except number 7. Specimens of this group incurred more damage than predicted by the "E" Modulus conditioned ratio of .49. This ratio indicates only moderate moisture damage but the actual stripping seen was extensive. This represents an apparent error of the method.

Marshall data was inconsistent for these mixes but would have eliminated the susceptible No. 3 mix because of low stability.

Source No. 3
Frenchtown
Appendix B, Reference Chart No. 3
Graphs Pages 82-88
Project I-90-2(35)85 U-1
Pit Location, SW¼ Sec. 28, T-15-N, R-26-W

Source No. 3 was an aggregate that had always performed exceptionally well in the field. The groups of specimens fabricated were with: (1) the mix design of the roadway, (2) hydrated lime, (3) fly ash, (4) cement. Except with specimens fabricated with fly ash, no significant stripping occurred. Immersion Compression, Tensile Stress, and "E" Modulus ratios all were high, except the "E" Modulus ratio of the saturated group 1 specimens was .39. This mix satisfied every other test and represents an apparent error with the "E" Modulus method of testing. Neither the moderate stripping of group No. 3 specimens nor the minor stripping of group 4 specimens, was detected by any of the tests. No explanations are offered for this phenomenon. The higher Immersion Compression ratios recorded were for the groups with the least stripping. The groups with the highest wet strength PSI would not have had the least stripping if the specimen set with hydrated lime had not been fabricated. Fly ash and cement additives appeared detrimental to these asphalt aggregate combinations which bonded well without them. Hydrated lime was beneficial but mixes without it were satisfactory.

Source No. 4
Forsyth - East and West
Appendix B, Reference Chart 4
Pit Location, N½, NW¼ Sec. 20, T-6-N, R-41-E
Graphs Pages 89-96

Source No. 4 was a very hard river gravel with very low absorption (< 1%). It represents a large percentage of our available aggregate. When it became obvious that Immersion Compression data was not corresponding to stripping or to other tests, it was discontinued for this series.

This was the first aggregate for which several groups were tested using Resilient Modulus Apparatus. The Resilient Modulus ratios that correspond to no stripping or minor stripping were above .7. When Resilient Modulus ratios were .5±, minor to moderate stripping was recorded. Some of the reductions of Resilient Modulus appear excessive in proportion to the amount of stripping that was observed.

"E" Modulus data also over-predicted stripping for groups 4 and 5.

Maximum Tensile Stress ratios correlated with the low stripping of these groups whose performance may be modified by the presence of fly ash and cement respectively.

Marshall flow criteria tended to eliminate several asphalt aggregate combinations that were subject to stripping (groups 6-10). Stability values did not account for many of the asphalt aggregate combinations that were very susceptible to moisture damage.

Immersion Compression data when re-examined yielded the best wet PSI with the groups that were most resistant to moisture induced damage.

Source No. 5
Coal Strip-Lame Deer
Appendix B, Reference Chart 5
Graphs Pages 97-104
Pit Location, Sec. 7, T-1-S, R-42-E

The fifth aggregate source was a "scoria" with high voids, high asphalt demand, and marginal design properties. Resilient Modulus testing, "E" Modulus and Tensile Stress ratios all were in agreement that sample number two with the hydrated lime additive had the best resistance to moisture induced damage of the four groups considered.

The Immersion Compression ratio of the group three specimens was higher than the ratio obtained with the other groups tested. The actual PSI of the Immersion Compression test of group three specimens was only about 1/3 that obtained with the other mixes. This is the most obvious example that the use of Immersion Compression ratios could lead to some rather tenuous conclusions about which asphalt aggregate combination was most resistant to moisture induced damage.

Conclusions

1. The use of Immersion Compression ratio as a test for moisture susceptibility is not fully reliable.

    a. When Immersion Compression ratios were low the material tested was susceptibile to moisture damage. When ratios were high the materials tested might not be susceptible but several asphalt aggregate combinations which produced high Immersion Compression ratios were susceptibile to moisture induced damage. These included aggregate source 1, group 3; aggregate 3, group 3; aggregate 4, group 2; and aggregate 5, group 3.

    b. The specimen group from each source with the highest Immersion Compression wet strength usually represented the most moisture resistant asphalt aggregate combination for each source.

2. Very high or low Marshall Stability of flow occurred only with mixes that were susceptible to moisture damage, we still concluded that Marshall data could not be relied upon for the identification of moisture susceptible asphalt aggregate combinations. This was because several of the mixes we tested that were susceptible to moisture damage satisfied Marshall requirements.

3. Resilient Modulus testing was not performed on enough specimens to be absolutely conclusive. No specimens that had Resilient Modulus ratios above .60 stripped significantly. The performance of the Resilient Modulus device was favorable. We are conducting further Resilient Modulus tests during our participation in the NCHRP 4-8(3)1 research program initiated by Dr. Lottman.

4. "E" Modulus testing data does not maintain enough stability of response to obtain usable data. The occasional elimination of a good mix using "E" Modulus criteria is sufficient justification for not using this test.

Conclusions (continued)

5. Maximum Tensile Stress testing is a low cost method that successfully identified and evaluated the susceptibility of asphalt aggregate combinations to moisture damage.

6. The use of high -200M material reduced moisture susceptibility when compactive effort was very high but susceptibility was increased when the compaction obtained was less than 98% of Marshall density.

Recommendations

1. Since a resistance to moisture induced damage is very important to the preservation of an asphalt aggregate bond, steps should be taken to insure that a resistance to stripping is designed into a mix.

2. Immersion Compression has enough value for detecting moisture susceptibility that its use should be retained. Immersion Compression ratios that were low did correspond to susceptible mixes. Immersion Compression comparisons of these same aggregate but with different fillers and with changes of other properties such as asphalt percent or grading usually yielded the highest Immersion Compression wet strength for the asphaltic combination with the best resistance to stripping. It is possible the Immersion Compression data utilization could be extended by requiring that the mixes with the highest wet strength obtained be used.

3. Resilient Modulus demonstrated good correlation with stripping. The use of Resilient Modulus criteria for designing moisture resistant asphaltic mixes could be introduced pending the outcome of NCHRP -4-8(3)1.

4. Maximum Tensile Stress testing used for dry, saturated, and conditioned asphalt specimens is a low cost method of predicting moisture induced damage that gives excellent correlation with stripping. Its simplicity and apparent reliability suggest that Maximum Tensile Stress testing should be conducted on all of the mix designs considered for asphaltic pavements. When a mix design has satisfied our conventional testing requirements, preference should be given to the asphalt-aggregate mix having the greatest Tensile Stress ratio.

   If a roadway is designed using Tensile Stress data, five year assessments should be conducted to determine if satisfactory field performance is obtained. If for reasons related to moisture susceptibility the performance of the pavements selected by maximum Tensile Stress ratio is poor, then the use of Maximum Tensile Stress testing criteria should be further investigated or discontinued.

Recommendations (continued)

5. Marshall data is used for other functions of mix design. It should not be a factor in determining the moisture susceptibility of asphalt aggregate combinations.

6. "E" Modulus eliminated too many good asphalt aggregate combinations and is too erratic to be used for a mix design evaluation. The equipment should be shelved.

7. The use of large percentages of -200M material greatly reduced moisture susceptibility when compactive effort was very high. Susceptibility to moisture was greatly increased when compaction was 96-98% of Marshall density. It is not advisable to attempt to increase a mix's resistance to moisture by adding excess -200M when 95% Marshall density requirements are in force.

Implementation

Maximum Tensile stress testing of asphalt specimens that have been tested dry, saturated and conditioned, provides reliable information pertaining to the moisture susceptibility of asphalt aggregate combinations.

To take advantage of these findings we will not have to introduce any new standards of specifications. It is our current policy to specify the asphalt percentage and the additive, if any, necessary to produce optimum mix properties. If we continue to produce a mix according to our standard practice, but additionally determine and specify the combination that is least susceptible to moisture induced damage, it will very simply initiate a mix design program in which moisture susceptibility is considered.

Benefits should be roadways that are more resistant to moisture induced damage. This will reduce maintenance and increase the service life of the roadway. The quality of the roadway should be enhanced by the reduction of stripping and raveling that are associated with moisture induced damage.

Further Research

1. Hydrated lime was the most effective additive in reducing stripping. However, with aggregate Source No. 2, which had good inherent resistance to stripping, the use of lime, cement, or fly ash decreased the moisture resistance of the specimens.

   The same effect occurred when fly ash or cement was added to aggregate Source No. 3 which also had good initial resistance to stripping. With these sources some additions were detrimental. This suggests that fillers or additives should be carefully tested with each asphalt aggregate combination before they are added as "insurance" against stripping.

2. This project has lead us to believe that moisture suceptibility of asphalt aggregate mixes is sensitive to the amount of -200M material.

   We found 0% - 200M undersirable, 1 - 2% acceptable, 3 - 4% undesirable, 4 - 11% produced satisfactory mixes. Seventeen percent -200M material was excessive and produced highly suceptible mixes unless optimum compaction was achieved.

   A future project could explore the possibility that this gradation phenomenon is not chance but a definable relationship that affects the moisture suceptibility of asphalt aggregate combinations.

APPENDIX A

All of the data developed and the pertinent design information of every test performed was coded onto punch cards. These cards were collated according to the columns of information that were to be compared. This provided a rapid listing of data organized according to any variable or sets of data that did not intersect. These lists could be arranged by stripping, or by treatment either by source or including all sources. The engineering variables of each unit of the testing could be examined for common factors. This capability enabled the isolation and evaluation of many of the relationships that were determined by this research. The computer listing eliminated tedious manual organization of data and made comparisons of any sort easy to accomplish.

This listing is arranged by source and component. It is more for illustration than for actual comparisons and contains all of the information that was reviewed during the research.

A brief key precedes the actual data listing and explains the coding used in the program.

Computer Printing Code *

Source Code

1. Divide North
2. Teton River-North & South
3. Frenchtown-East & West
4. Forsyth - East & West
5. Coalstrip - Lame Deer

Sample specific weight (DENSITY)

Component (CMP)

1. Immersion Compression
2. Tensile Split
3. "E" Modulus
4. Resilient Modulus
5. Stability
6. Flow

Asphalt Source (SRC)

1. Continental
2. Phillips

Filler (FIL)

0 - none
1 - lime
2 - fly ash
3 - cement

Stripping (STR)

0 - No report
1 - none
2 - light
3 - moderate
4 - severe

Percent of -200M (200M)

Treatment (TRT)

0 - dry
1 - saturated
2 - conditioned
3 - Immersion-Compression (dry)
4 - Immersion-Compression (Soaked)

* The letters in the parenthesis are the abbreviated column heading used. All 0.00 output represented information that was not obtained. One digit column zeros are significant as interpreted on this sheet.

'E' MODULUS RESEARCH DATA CORRELATION

SAMPLE NO.	SOURCE CODE	ASPHALT CONTENT %	SRC	FIL	200M	TRT	PERMEABLE VOIDS	MARSHALL VOIDS	DENSITY	CMP	STRESS LEVEL	STR
133	01	6.5	1	0	9.3	3	0.00	0.00	0.00	1	161.6	0
134	01	6.5	1	0	9.3	3	0.00	0.00	0.00	1	187.8	0
135	01	6.5	1	0	9.3	3	0.00	0.00	0.00	1	184.6	0
136	01	6.5	1	0	17.8	3	0.00	0.00	0.00	1	175.1	0
137	01	6.5	1	0	17.8	3	0.00	0.00	0.00	1	182.2	0
138	01	6.5	1	0	17.8	3	0.00	0.00	0.00	1	185.4	0
145	01	6.5	1	0	4.2	3	0.00	0.00	0.00	1	136.9	0
146	01	6.5	1	0	4.2	3	0.00	0.00	0.00	1	133.7	0
147	01	6.5	1	0	4.2	3	0.00	0.00	0.00	1	149.6	0
124	01	6.5	1	0	9.3	4	0.00	0.00	0.00	1	156.0	0
125	01	6.5	1	0	9.3	4	0.00	0.00	0.00	1	172.7	0
126	01	6.5	1	0	9.3	4	0.00	0.00	0.00	1	158.4	0
130	01	6.5	1	0	17.8	4	0.00	0.00	0.00	1	159.2	0
131	01	6.5	1	0	17.8	4	0.00	0.00	0.00	1	166.3	0
132	01	6.5	1	0	17.8	4	0.00	0.00	0.00	1	176.7	0
148	01	6.5	1	0	4.2	4	0.00	0.00	0.00	1	127.3	0
149	01	6.5	1	0	4.2	4	0.00	0.00	0.00	1	138.5	0
150	01	6.5	1	0	4.2	4	0.00	0.00	0.00	1	135.3	0

'E' MODULUS RESEARCH DATA CORRELATION

SAMPLE NO.	SOURCE CODE	ASPHALT CONTENT %	SRC	FIL	200M	TRT	PERMEABLE VOIDS	MARSHALL VOIDS	DENSITY	CMP	STRESS LEVEL	STR
169	02	6.5	2	0	17.3	3	0.00	0.00	0.00	1	284.9	0
170	02	6.5	2	0	17.3	3	0.00	0.00	0.00	1	308.0	0
171	02	6.5	2	0	17.3	3	0.00	0.00	0.00	1	286.5	0
172	02	6.5	2	0	17.3	3	0.00	0.00	0.00	1	297.6	0
193	02	6.5	2	0	8.6	3	0.00	0.00	0.00	1	143.2	0
194	02	6.5	2	0	8.6	3	0.00	0.00	0.00	1	153.6	0
195	02	6.5	2	0	8.6	3	0.00	0.00	0.00	1	153.6	0
196	02	6.5	2	0	8.6	3	0.00	0.00	0.00	1	160.8	0
241	02	6.5	2	1	8.6	3	0.00	0.00	0.00	1	155.2	0
242	02	6.5	2	1	8.6	3	0.00	0.00	0.00	1	163.1	0
243	02	6.5	2	1	8.6	3	0.00	0.00	0.00	1	152.8	0
262	02	6.5	2	2	8.6	3	0.00	0.00	0.00	1	133.7	0
263	02	6.5	2	2	8.6	3	0.00	0.00	0.00	1	138.5	0
264	02	6.5	2	2	8.6	3	0.00	0.00	0.00	1	126.5	0
283	02	6.5	2	3	8.6	3	0.00	0.00	0.00	1	154.4	0
284	02	6.5	2	3	8.6	3	0.00	0.00	0.00	1	163.9	0
285	02	6.5	2	3	8.6	3	0.00	0.00	0.00	1	157.6	0
304	02	6.8	2	0	17.3	3	0.00	0.00	0.00	1	232.4	0
305	02	6.8	2	0	17.3	3	0.00	0.00	0.00	1	240.3	0
306	02	6.8	2	0	17.3	3	0.00	0.00	0.00	1	240.3	0
345	02	6.5	2	0	8.6	3	0.00	0.00	0.00	1	207.3	1
346	02	6.5	2	0	8.6	3	0.00	0.00	0.00	1	190.2	1
347	02	6.5	2	0	8.6	3	0.00	0.00	0.00	1	192.6	1
366	02	8.0	2	1	8.6	3	0.00	0.00	0.00	1	214.9	0
367	02	8.0	2	1	8.6	3	0.00	0.00	0.00	1	239.5	0
368	02	8.0	2	1	8.6	3	0.00	0.00	0.00	1	236.4	0
387	02	8.0	2	2	8.6	3	0.00	0.00	0.00	1	159.2	0
388	02	8.0	2	2	8.6	3	0.00	0.00	0.00	1	140.9	0
389	02	8.0	2	2	8.6	3	0.00	0.00	0.00	1	143.2	0
408	02	8.0	2	3	8.6	3	0.00	0.00	0.00	1	168.7	0
409	02	8.0	2	3	8.6	3	0.00	0.00	0.00	1	177.5	0
410	02	8.0	2	3	8.6	3	0.00	0.00	0.00	1	178.3	0
173	02	6.5	2	0	17.3	4	0.00	0.00	0.00	1	162.3	0
174	02	6.5	2	0	17.3	4	0.00	0.00	0.00	1	160.8	0
175	02	6.5	2	0	17.3	4	0.00	0.00	0.00	1	144.8	0
176	02	6.5	2	0	17.3	4	0.00	0.00	0.00	1	182.2	0
197	02	6.5	2	0	8.6	4	0.00	0.00	0.00	1	78.8	0
198	02	6.5	2	0	8.6	4	0.00	0.00	0.00	1	75.6	0
199	02	6.5	2	0	8.6	4	0.00	0.00	0.00	1	75.6	0
200	02	6.5	2	0	8.6	4	0.00	0.00	0.00	1	68.4	0
244	02	6.5	2	1	8.6	4	0.00	0.00	0.00	1	101.9	0
245	02	6.5	2	1	8.6	4	0.00	0.00	0.00	1	110.6	0
246	02	6.5	2	1	8.6	4	0.00	0.00	0.00	1	133.7	0
265	02	6.5	2	2	8.6	4	0.00	0.00	0.00	1	87.5	0
266	02	6.5	2	2	8.6	4	0.00	0.00	0.00	1	71.6	0
267	02	6.5	2	2	8.6	4	0.00	0.00	0.00	1	74.8	0
286	02	6.5	2	3	8.6	4	0.00	0.00	0.00	1	82.8	0
287	02	6.5	2	3	8.6	4	0.00	0.00	0.00	1	95.5	0
288	02	6.5	2	3	8.6	4	0.00	0.00	0.00	1	98.7	0
307	02	6.8	2	0	17.3	4	0.00	0.00	0.00	1	150.4	0
308	02	6.8	2	0	17.3	4	0.00	0.00	0.00	1	161.9	0
309	02	6.8	2	0	17.3	4	0.00	0.00	0.00	1	148.4	0
348	02	6.5	2	0	8.6	4	0.00	0.00	0.00	1	165.5	1
349	02	6.5	2	0	8.6	4	0.00	0.00	0.00	1	154.8	1

'E' MODULUS RESEARCH DATA CORRELATION

SAMPLE NO.	SOURCE CODE	ASPHALT CONTENT %	SRC	FIL	200M	TRT	PERMEABLE VOIDS	MARSHALL VOIDS	DENSITY	CMP	STRESS LEVEL	STR
350	02	6.5	2	0	8.6	4	0.00	0.00	0.00	1	156.0	1
369	02	8.0	2	1	8.6	4	0.00	0.00	0.00	1	234.8	0
370	02	8.0	2	1	8.6	4	0.00	0.00	0.00	1	238.7	0
371	02	8.0	2	1	8.6	4	0.00	0.00	0.00	1	241.1	0
390	02	8.0	2	2	8.6	4	0.00	0.00	0.00	1	154.4	0
391	02	8.0	2	2	8.6	4	0.00	0.00	0.00	1	144.0	0
392	02	8.0	2	2	8.6	4	0.00	0.00	0.00	1	148.8	0
411	02	8.0	2	3	8.6	4	0.00	0.00	0.00	1	173.5	0
412	02	8.0	2	3	8.6	4	0.00	0.00	0.00	1	171.9	0
413	02	8.0	2	3	8.6	4	0.00	0.00	0.00	1	175.1	0
434	02	6.5	2	0	6.9	4	0.00	0.00	0.00	1	144.8	0

'E' MODULUS RESEARCH DATA CORRELATION

SAMPLE NO.	SOURCE CODE	ASPHALT CONTENT %	SRC	FIL	200M	TRT	PERMEABLE VOIDS	MARSHALL VOIDS	DENSITY	CMP	STRESS LEVEL	STR
429	03	6.5	2	0	6.9	3	0.00	0.00	0.00	1	105.8	0
430	03	6.5	2	0	6.9	3	0.00	0.00	0.00	1	115.4	0
431	03	6.5	2	0	6.9	3	0.00	0.00	0.00	1	121.8	0
450	03	6.5	2	1	6.9	3	0.00	0.00	0.00	1	168.7	0
451	03	6.5	2	1	6.9	3	0.00	0.00	0.00	1	176.7	0
452	03	6.5	2	1	6.9	3	0.00	0.00	0.00	1	176.4	0
471	03	6.5	2	2	6.9	3	0.00	0.00	0.00	1	156.8	0
472	03	6.5	2	2	6.9	3	0.00	0.00	0.00	1	157.6	0
473	03	6.5	2	2	6.9	3	0.00	0.00	0.00	1	153.6	0
492	03	6.5	2	3	6.9	3	0.00	0.00	0.00	1	145.6	0
493	03	6.5	2	3	6.9	3	0.00	0.00	0.00	1	163.1	0
494	03	6.5	2	3	6.9	3	0.00	0.00	0.00	1	163.9	0
432	03	6.5	2	0	6.9	4	0.00	0.00	0.00	1	146.4	0
433	03	6.5	2	0	6.9	4	0.00	0.00	0.00	1	146.4	0
453	03	6.5	2	1	6.9	4	0.00	0.00	0.00	1	171.9	0
454	03	6.5	2	1	6.9	4	0.00	0.00	0.00	1	194.2	0
455	03	6.5	2	1	6.9	4	0.00	0.00	0.00	1	180.6	0
474	03	6.5	2	2	6.9	4	0.00	0.00	0.00	1	149.6	0
475	03	6.5	2	2	6.9	4	0.00	0.00	0.00	1	152.0	0
476	03	6.5	2	2	6.9	4	0.00	0.00	0.00	1	140.1	0
495	03	6.5	2	3	6.9	4	0.00	0.00	0.00	1	146.4	0
496	03	6.5	2	3	6.9	4	0.00	0.00	0.00	1	157.6	0
497	03	6.5	2	3	6.9	4	0.00	0.00	0.00	1	144.8	0

'E' MODULUS RESEARCH DATA CORRELATION

SAMPLE NO.	SOURCE CODE	ASPHALT CONTENT %	SRC	FIL	200M	TRT	PERMEABLE VOIDS	MARSHALL VOIDS	DENSITY	CMP	STRESS LEVEL	STR
513	04	6.2	2	0	4.6	3	0.00	0.00	0.00	1	124.1	0
514	04	6.2	2	0	4.6	3	0.00	0.00	0.00	1	107.4	0
515	04	6.2	2	0	4.6	3	0.00	0.00	0.00	1	111.4	0
549	04	5.7	2	0	4.6	3	0.00	0.00	0.00	1	103.5	0
550	04	5.7	2	0	4.6	3	0.00	0.00	0.00	1	98.7	0
551	04	5.7	2	0	4.6	3	0.00	0.00	0.00	1	95.5	0
555	04	6.2	2	1	4.6	3	0.00	0.00	0.00	1	167.1	0
556	04	6.2	2	1	4.6	3	0.00	0.00	0.00	1	168.7	0
557	04	6.2	2	1	4.6	3	0.00	0.00	0.00	1	162.3	0
576	04	6.2	2	2	4.6	3	0.00	0.00	0.00	1	127.3	0
577	04	6.2	2	2	4.6	3	0.00	0.00	0.00	1	144.8	0
578	04	6.2	2	2	4.6	3	0.00	0.00	0.00	1	130.5	0
597	04	6.2	2	3	4.6	3	0.00	0.00	0.00	1	124.9	0
598	04	6.2	2	3	4.6	3	0.00	0.00	0.00	1	132.1	0
599	04	6.2	2	3	4.6	3	0.00	0.00	0.00	1	144.8	0
516	04	6.2	2	0	4.6	4	0.00	0.00	0.00	1	85.3	0
517	04	6.2	2	0	4.6	4	0.00	0.00	0.00	1	112.6	0
518	04	6.2	2	0	4.6	4	0.00	0.00	0.00	1	94.3	0
552	04	5.7	2	0	4.6	4	0.00	0.00	0.00	1	103.5	0
553	04	5.7	2	0	4.6	4	0.00	0.00	0.00	1	104.8	0
554	04	5.7	2	0	4.6	4	0.00	0.00	0.00	1	116.7	0
558	04	6.2	2	1	4.6	4	0.00	0.00	0.00	1	143.2	0
559	04	6.2	2	1	4.6	4	0.00	0.00	0.00	1	155.2	0
560	04	6.2	2	1	4.6	4	0.00	0.00	0.00	1	154.4	0
579	04	6.2	2	2	4.6	4	0.00	0.00	0.00	1	126.5	0
580	04	6.2	2	2	4.6	4	0.00	0.00	0.00	1	122.6	0
581	04	6.2	2	2	4.6	4	0.00	0.00	0.00	1	127.3	0
600	04	6.2	2	3	4.6	4	0.00	0.00	0.00	1	132.9	0
601	04	6.2	2	3	4.6	4	0.00	0.00	0.00	1	130.5	0
602	04	6.2	2	3	4.6	4	0.00	0.00	0.00	1	134.5	0

'E' MODULUS RESEARCH DATA CORRELATION

SAMPLE NO.	SOURCE CODE	ASPHALT CONTENT %	SRC	FIL	200M	TRT	PERMEABLE VOIDS	MARSHALL VOIDS	DENSITY	CMP	STRESS LEVEL	STR
618	05	8.5	1	0	8.7	3	0.00	0.00	0.00	1	164.7	0
619	05	8.5	1	0	8.7	3	0.00	0.00	0.00	1	163.9	0
620	05	8.5	1	0	8.7	3	0.00	0.00	0.00	1	144.8	0
660	05	8.0	1	0	8.7	3	0.00	0.00	0.00	1	35.8	0
661	05	8.0	1	0	8.7	3	0.00	0.00	0.00	1	32.6	0
662	05	8.0	1	0	8.7	3	0.00	0.00	0.00	1	41.4	0
621	05	8.5	1	0	8.7	4	0.00	0.00	0.00	1	154.4	0
622	05	8.5	1	0	8.7	4	0.00	0.00	0.00	1	149.6	0
623	05	8.5	1	0	8.7	4	0.00	0.00	0.00	1	170.3	0
663	05	8.0	1	0	8.7	4	0.00	0.00	0.00	1	45.4	0
664	05	8.0	1	0	8.7	4	0.00	0.00	0.00	1	47.8	0

'E' MODULUS RESEARCH DATA CORRELATION

SAMPLE NO.	SOURCE CODE	ASPHALT CONTENT %	SRC	FIL	200M	TRT	PERMEABLE VOIDS	MARSHALL VOIDS	DENSITY	CMP	STRESS LEVEL	STR
798	01	6.5	1	0	4.2	0	0.00	0.00	0.00	2	58.8	1
799	01	6.5	1	0	4.2	0	0.00	0.00	0.00	2	57.8	1
800	01	6.5	1	0	4.2	0	0.00	0.00	0.00	2	71.6	1
801	01	6.5	1	0	4.2	0	0.00	0.00	0.00	2	66.9	1
802	01	6.5	1	0	4.2	1	0.00	0.00	0.00	2	45.8	2
803	01	6.5	1	0	4.2	1	0.00	0.00	0.00	2	49.6	2
804	01	6.5	1	0	4.2	1	0.00	0.00	0.00	2	43.8	2
805	01	6.5	1	0	4.2	1	0.00	0.00	0.00	2	50.9	2
806	01	6.5	1	0	4.2	2	2.81	0.00	0.00	2	26.8	3
807	01	6.5	1	0	4.2	2	2.72	0.00	0.00	2	37.6	3
808	01	6.5	1	0	4.2	2	1.93	0.00	0.00	2	33.0	3
809	01	6.5	1	0	4.2	2	3.17	0.00	0.00	2	29.4	3
798	01	6.5	1	0	4.2	0	0.00	0.00	0.00	3	100000.0	1
799	01	6.5	1	0	4.2	0	0.00	0.00	0.00	3	54000.0	1
800	01	6.5	1	0	4.2	0	0.00	0.00	0.00	3	120000.0	1
801	01	6.5	1	0	4.2	0	0.00	0.00	0.00	3	75000.0	1
802	01	6.5	1	0	4.2	1	0.00	0.00	0.00	3	21000.0	2
803	01	6.5	1	0	4.2	1	0.00	0.00	0.00	3	56000.0	2
804	01	6.5	1	0	4.2	1	0.00	0.00	0.00	3	82000.0	2
805	01	6.5	1	0	4.2	1	0.00	0.00	0.00	3	28000.0	2
806	01	6.5	1	0	4.2	2	2.81	0.00	0.00	3	13000.0	3
807	01	6.5	1	0	4.2	2	2.72	0.00	0.00	3	52000.0	3
808	01	6.5	1	0	4.2	2	1.93	0.00	0.00	3	37000.0	3
809	01	6.5	1	0	4.2	2	3.17	0.00	0.00	3	26000.0	3
798	01	6.5	1	0	4.2	0	0.00	0.00	0.00	4	902000.0	1
799	01	6.5	1	0	4.2	0	0.00	0.00	0.00	4	858000.0	1
800	01	6.5	1	0	4.2	0	0.00	0.00	0.00	4	1014000.0	1
801	01	6.5	1	0	4.2	0	0.00	0.00	0.00	4	1116000.0	1
802	01	6.5	1	0	4.2	1	0.00	0.00	0.00	4	438000.0	2
803	01	6.5	1	0	4.2	1	0.00	0.00	0.00	4	550000.0	2
804	01	6.5	1	0	4.2	1	0.00	0.00	0.00	4	684000.0	2
805	01	6.5	1	0	4.2	1	0.00	0.00	0.00	4	420000.0	2
806	01	6.5	1	0	4.2	2	2.81	0.00	0.00	4	256000.0	3
807	01	6.5	1	0	4.2	2	2.72	0.00	0.00	4	500000.0	3
808	01	6.5	1	0	4.2	2	1.93	0.00	0.00	4	367000.0	3
809	01	6.5	1	0	4.2	2	3.17	0.00	0.00	4	354000.0	3

'E' MODULUS RESEARCH DATA CORRELATION

SAMPLE NO.	SOURCE CODE	ASPHALT CONTENT %	SRC	FIL	200M	TRT	PERMEABLE VOIDS	MARSHALL VOIDS	DENSITY	CMP	STRESS LEVEL	STR
345	02	6.5	2	0	8.6	3	0.00	0.00	0.00	1	207.3	1
346	02	6.5	2	0	8.6	3	0.00	0.00	0.00	1	190.2	1
347	02	6.5	2	0	8.6	3	0.00	0.00	0.00	1	192.6	1
348	02	6.5	2	0	8.6	4	0.00	0.00	0.00	1	165.5	1
349	02	6.5	2	0	8.6	4	0.00	0.00	0.00	1	154.8	1
350	02	6.5	2	0	8.6	4	0.00	0.00	0.00	1	156.0	1
181	02	6.5	2	0	17.3	0	0.00	0.00	0.00	2	74.0	1
182	02	6.5	2	0	17.3	0	0.00	0.00	0.00	2	72.2	1
183	02	6.5	2	0	17.3	0	0.00	0.00	0.00	2	71.3	1
184	02	6.5	2	0	17.3	0	0.00	0.00	0.00	2	74.9	1
185	02	6.5	2	0	17.3	1	2.75	0.00	0.00	2	53.8	1
186	02	6.5	2	0	17.3	1	2.11	0.00	0.00	2	61.4	1
187	02	6.5	2	0	17.3	1	1.92	0.00	0.00	2	55.3	1
188	02	6.5	2	0	17.3	1	2.91	0.00	0.00	2	45.0	1
189	02	6.5	2	0	17.3	2	2.02	0.00	0.00	2	51.7	1
190	02	6.5	2	0	17.3	2	1.41	0.00	0.00	2	53.8	1
191	02	6.5	2	0	17.3	2	2.40	0.00	0.00	2	42.8	1
192	02	6.5	2	0	17.3	2	2.31	0.00	0.00	2	46.3	1
205	02	6.5	2	0	8.6	0	0.00	0.00	0.00	2	43.7	1
206	02	6.5	2	0	8.6	0	0.00	0.00	0.00	2	55.6	1
207	02	6.5	2	0	8.6	0	0.00	0.00	0.00	2	56.3	1
208	02	6.5	2	0	8.6	0	0.00	0.00	0.00	2	58.9	1
209	02	6.5	2	0	8.6	1	5.80	0.00	0.00	2	30.1	2
210	02	6.5	2	0	8.6	1	5.55	0.00	0.00	2	30.2	2
211	02	6.5	2	0	8.6	1	5.16	0.00	0.00	2	19.9	2
212	02	6.5	2	0	8.6	1	5.32	0.00	0.00	2	26.2	2
213	02	6.5	2	0	8.6	2	5.71	0.00	0.00	2	9.8	3
214	02	6.5	2	0	8.6	2	5.21	0.00	0.00	2	15.1	3
215	02	6.5	2	0	8.6	2	5.39	0.00	0.00	2	15.4	3
216	02	6.5	2	0	8.6	2	4.72	0.00	0.00	2	19.4	3
233	02	6.5	2	0	8.6	1	4.90	0.00	0.00	2	36.3	3
234	02	6.5	2	0	8.6	1	4.14	0.00	0.00	2	35.9	3
235	02	6.5	2	0	8.6	1	4.88	0.00	0.00	2	36.1	3
236	02	6.5	2	0	8.6	1	4.46	0.00	0.00	2	27.1	3
237	02	6.5	2	0	8.6	2	4.42	0.00	0.00	2	17.1	4
238	02	6.5	2	0	8.6	2	3.89	0.00	0.00	2	22.5	4
239	02	6.5	2	0	8.6	2	4.33	0.00	0.00	2	15.4	4
240	02	6.5	2	0	8.6	2	4.43	0.00	0.00	2	20.9	4
313	02	6.8	2	0	17.3	0	0.00	0.00	0.00	2	51.1	1
314	02	6.8	2	0	17.3	0	0.00	0.00	0.00	2	57.1	1
315	02	6.8	2	0	17.3	0	0.00	0.00	0.00	2	50.9	1
316	02	6.8	2	0	17.3	0	0.00	0.00	0.00	2	53.1	1
317	02	6.8	2	0	17.3	1	2.50	0.00	0.00	2	45.6	1
318	02	6.8	2	0	17.3	1	1.80	0.00	0.00	2	37.7	1
319	02	6.8	2	0	17.3	1	2.10	0.00	0.00	2	49.3	1
320	02	6.8	2	0	17.3	1	1.50	0.00	0.00	2	49.0	1
321	02	6.8	2	0	17.3	2	1.41	0.00	0.00	2	45.6	3
322	02	6.8	2	0	17.3	2	2.49	0.00	0.00	2	36.2	3
323	02	6.8	2	0	17.3	2	2.20	0.00	0.00	2	37.2	3
324	02	6.8	2	0	17.3	2	1.31	0.00	0.00	2	39.1	3
325	02	6.5	2	0	17.3	0	0.00	0.00	0.00	2	48.0	1
326	02	6.5	2	0	17.3	1	7.01	0.00	0.00	2	11.6	3
327	02	6.5	2	0	17.3	2	5.83	0.00	0.00	2	10.0	4
328	02	6.5	2	0	17.3	0	0.00	0.00	0.00	2	38.2	1

'E' MODULUS RESEARCH DATA CORRELATION

SAMPLE NO.	SOURCE CODE	ASPHALT CONTENT %	SRC	FIL	200M	TRT	PERMEABLE VOIDS	MARSHALL VOIDS	DENSITY	CMP	STRESS LEVEL	STR
329	02	6.5	2	0	17.3	1	5.85	0.00	0.00	2	15.1	3
330	02	6.5	2	0	17.3	2	6.12	0.00	0.00	2	7.2	4
331	02	6.5	2	0	17.3	0	0.00	0.00	0.00	2	47.6	1
332	02	6.5	2	0	17.3	1	3.77	0.00	0.00	2	33.2	3
333	02	6.5	2	0	17.3	2	5.57	0.00	0.00	2	10.2	4
334	02	6.5	2	0	17.3	0	0.00	0.00	0.00	2	44.6	1
335	02	6.5	2	0	17.3	1	3.20	0.00	0.00	2	38.9	3
336	02	6.5	2	0	17.3	2	4.86	0.00	0.00	2	15.9	4
354	02	6.5	2	0	8.6	0	0.00	0.00	0.00	2	39.3	1
355	02	6.5	2	0	8.6	0	0.00	0.00	0.00	2	41.4	1
356	02	6.5	2	0	8.6	0	0.00	0.00	0.00	2	47.4	1
357	02	6.5	2	0	8.6	0	0.00	0.00	0.00	2	38.6	1
358	02	6.5	2	0	8.6	1	3.75	0.00	0.00	2	37.0	1
359	02	6.5	2	0	8.6	1	4.40	0.00	0.00	2	36.6	1
360	02	6.5	2	0	8.6	1	4.01	0.00	0.00	2	49.5	1
361	02	6.5	2	0	8.6	1	3.94	0.00	0.00	2	46.0	1
362	02	6.5	2	0	8.6	2	3.49	0.00	0.00	2	45.4	1
363	02	6.5	2	0	8.6	2	3.59	0.00	0.00	2	42.6	1
364	02	6.5	2	0	8.6	2	3.90	0.00	0.00	2	41.2	1
365	02	6.5	2	0	8.6	2	3.23	0.00	0.00	2	42.2	1
182	02	6.5	2	0	17.3	0	0.00	0.00	0.00	3	160000.0	1
183	02	6.5	2	0	17.3	0	0.00	0.00	0.00	3	208000.0	1
184	02	6.5	2	0	17.3	0	0.00	0.00	0.00	3	200000.0	1
185	02	6.5	2	0	17.3	1	2.75	0.00	0.00	3	70000.0	1
186	02	6.5	2	0	17.3	1	2.11	0.00	0.00	3	95000.0	1
187	02	6.5	2	0	17.3	1	1.92	0.00	0.00	3	91000.0	1
188	02	6.5	2	0	17.3	1	2.91	0.00	0.00	3	60000.0	1
189	02	6.5	2	0	17.3	2	2.02	0.00	0.00	3	38000.0	1
191	02	6.5	2	0	17.3	2	2.40	0.00	0.00	3	72000.0	1
192	02	6.5	2	0	17.3	2	2.31	0.00	0.00	3	26000.0	1
205	02	6.5	2	0	8.6	0	0.00	0.00	0.00	3	85000.0	1
206	02	6.5	2	0	8.6	0	0.00	0.00	0.00	3	112000.0	1
207	02	6.5	2	0	8.6	0	0.00	0.00	0.00	3	100000.0	1
208	02	6.5	2	0	8.6	0	0.00	0.00	0.00	3	106000.0	1
209	02	6.5	2	0	8.6	1	5.80	0.00	0.00	3	27000.0	2
210	02	6.5	2	0	8.6	1	5.55	0.00	0.00	3	35000.0	2
211	02	6.5	2	0	8.6	1	5.16	0.00	0.00	3	36000.0	2
212	02	6.5	2	0	8.6	1	5.32	0.00	0.00	3	31000.0	2
213	02	6.5	2	0	8.6	2	5.71	0.00	0.00	3	12000.0	3
214	02	6.5	2	0	8.6	2	5.21	0.00	0.00	3	13000.0	3
215	02	6.5	2	0	8.6	2	5.39	0.00	0.00	3	14000.0	3
216	02	6.5	2	0	8.6	2	4.72	0.00	0.00	3	11500.0	3
233	02	6.5	2	0	8.6	1	4.90	0.00	0.00	3	17000.0	3
234	02	6.5	2	0	8.6	1	4.14	0.00	0.00	3	8200.0	3
235	02	6.5	2	0	8.6	1	4.88	0.00	0.00	3	13700.0	3
236	02	6.5	2	0	8.6	1	4.46	0.00	0.00	3	8600.0	3
237	02	6.5	2	0	8.6	2	4.42	0.00	0.00	3	16000.0	4
238	02	6.5	2	0	8.6	2	3.89	0.00	0.00	3	16000.0	4
239	02	6.5	2	0	8.6	2	4.33	0.00	0.00	3	11500.0	4
240	02	6.5	2	0	8.6	2	4.43	0.00	0.00	3	15000.0	4
314	02	6.8	2	0	17.3	0	0.00	0.00	0.00	3	70000.0	1
315	02	6.8	2	0	17.3	0	0.00	0.00	0.00	3	70000.0	1
316	02	6.8	2	0	17.3	0	0.00	0.00	0.00	3	89000.0	1
317	02	6.8	2	0	17.3	1	2.50	0.00	0.00	3	46000.0	1

'E' MODULUS RESEARCH DATA CORRELATION

SAMPLE NO.	SOURCE CODE	ASPHALT CONTENT %	SRC	FIL	200M	TRT	PERMEABLE VOIDS	MARSHALL VOIDS	DENSITY	CMP	STRESS LEVEL	STR
318	02	6.8	2	0	17.3	1	1.80	0.00	0.00	3	75000.0	1
319	02	6.8	2	0	17.3	1	2.10	0.00	0.00	3	43000.0	1
321	02	6.8	2	0	17.3	2	1.41	0.00	0.00	3	50000.0	3
322	02	6.8	2	0	17.3	2	2.49	0.00	0.00	3	39000.0	3
323	02	6.8	2	0	17.3	2	2.20	0.00	0.00	3	71000.0	3
325	02	6.5	2	0	17.3	0	0.00	0.00	0.00	3	63000.0	1
326	02	6.5	2	0	17.3	1	7.01	0.00	0.00	3	30000.0	3
327	02	6.5	2	0	17.3	2	5.83	0.00	0.00	3	17500.0	4
328	02	6.5	2	0	17.3	0	0.00	0.00	0.00	3	44000.0	1
329	02	6.5	2	0	17.3	1	5.85	0.00	0.00	3	20000.0	3
330	02	6.5	2	0	17.3	2	6.12	0.00	0.00	3	15000.0	4
331	02	6.5	2	0	17.3	0	0.00	0.00	0.00	3	53000.0	1
332	02	6.5	2	0	17.3	1	3.77	0.00	0.00	3	31500.0	3
333	02	6.5	2	0	17.3	2	5.57	0.00	0.00	3	9000.0	4
334	02	6.5	2	0	17.3	0	0.00	0.00	0.00	3	60000.0	1
335	02	6.5	2	0	17.3	1	3.20	0.00	0.00	3	59500.0	3
336	02	6.5	2	0	17.3	2	4.86	0.00	0.00	3	19000.0	4
354	02	6.5	2	0	8.6	0	0.00	0.00	0.00	3	41000.0	1
355	02	6.5	2	0	8.6	0	0.00	0.00	0.00	3	26000.0	1
356	02	6.5	2	0	8.6	0	0.00	0.00	0.00	3	45000.0	1
357	02	6.5	2	0	8.6	0	0.00	0.00	0.00	3	38000.0	1
358	02	6.5	2	0	8.6	1	3.75	0.00	0.00	3	26000.0	1
359	02	6.5	2	0	8.6	1	4.40	0.00	0.00	3	26000.0	1
360	02	6.5	2	0	8.6	1	4.01	0.00	0.00	3	51500.0	1
361	02	6.5	2	0	8.6	1	3.94	0.00	0.00	3	32000.0	1
362	02	6.5	2	0	8.6	2	3.49	0.00	0.00	3	51000.0	1
363	02	6.5	2	0	8.6	2	3.59	0.00	0.00	3	37500.0	1
364	02	6.5	2	0	8.6	2	3.90	0.00	0.00	3	32000.0	1
365	02	6.5	2	0	8.6	2	3.23	0.00	0.00	3	27000.0	1
351	02	6.5	2	0	8.6	0	0.00	3.56	2.33	5	1185.0	1
352	02	6.5	2	0	8.6	0	0.00	3.64	2.33	5	1150.0	1
353	02	6.5	2	0	8.6	0	0.00	3.93	2.32	5	1185.0	1
351	02	6.5	2	0	8.6	0	0.00	3.56	2.33	6	15.0	1
352	02	6.5	2	0	8.6	0	0.00	3.64	2.33	6	13.0	1
353	02	6.5	2	0	8.6	0	0.00	3.93	2.32	6	13.0	1
250	02	6.5	2	1	8.6	0	0.00	0.00	0.00	2	62.5	1
251	02	6.5	2	1	8.6	0	0.00	0.00	0.00	2	61.8	1
253	02	6.5	2	1	8.6	0	0.00	0.00	0.00	2	57.6	1
254	02	6.5	2	1	8.6	1	3.61	0.00	0.00	2	61.0	2
255	02	6.5	2	1	8.6	1	4.18	0.00	0.00	2	55.7	2
256	02	6.5	2	1	8.6	1	3.82	0.00	0.00	2	51.4	2
258	02	6.5	2	1	8.6	2	3.95	0.00	0.00	2	32.6	3
259	02	6.5	2	1	8.6	2	4.26	0.00	0.00	2	33.7	3
260	02	6.5	2	1	8.6	2	4.46	0.00	0.00	2	36.7	3
261	02	6.5	2	1	8.6	2	5.11	0.00	0.00	2	30.9	3
375	02	8.0	2	1	8.6	0	0.00	0.00	0.00	2	61.6	1
376	02	8.0	2	1	8.6	0	0.00	0.00	0.00	2	72.3	1
377	02	8.0	2	1	8.6	0	0.00	0.00	0.00	2	70.2	1
378	02	8.0	2	1	8.6	0	0.00	0.00	0.00	2	65.9	1
379	02	8.0	2	1	8.6	1	1.38	0.00	0.00	2	71.8	1
380	02	8.0	2	1	8.6	1	1.83	0.00	0.00	2	71.4	1
381	02	8.0	2	1	8.6	1	1.47	0.00	0.00	2	72.3	1
382	02	8.0	2	1	8.6	1	1.47	0.00	0.00	2	64.8	1
383	02	8.0	2	1	8.6	2	1.73	0.00	0.00	2	56.7	1

'E' MODULUS RESEARCH DATA CORRELATION

SAMPLE NO.	SOURCE CODE	ASPHALT CONTENT %	SRC	FIL	200M	TRT	PERMEABLE VOIDS	MARSHALL VOIDS	DENSITY	CMP	STRESS LEVEL	STR
384	02	8.0	2	1	8.6	2	1.57	0.00	0.00	2	55.6	1
385	02	8.0	2	1	8.6	2	1.30	0.00	0.00	2	55.9	1
386	02	8.0	2	1	8.6	2	1.29	0.00	0.00	2	56.1	1
250	02	6.5	2	1	8.6	0	0.00	0.00	0.00	3	199000.0	1
251	02	6.5	2	1	8.6	0	0.00	0.00	0.00	3	103000.0	1
252	02	6.5	2	1	8.6	0	0.00	0.00	0.00	3	200000.0	1
253	02	6.5	2	1	8.6	0	0.00	0.00	0.00	3	160000.0	1
254	02	6.5	2	1	8.6	1	3.61	0.00	0.00	3	155000.0	2
255	02	6.5	2	1	8.6	1	4.18	0.00	0.00	3	90000.0	2
256	02	6.5	2	1	8.6	1	3.82	0.00	0.00	3	108000.0	2
257	02	6.5	2	1	8.6	1	4.63	0.00	0.00	3	53000.0	2
258	02	6.5	2	1	8.6	2	3.95	0.00	0.00	3	80000.0	3
259	02	6.5	2	1	8.6	2	4.26	0.00	0.00	3	45000.0	3
260	02	6.5	2	1	8.6	2	4.46	0.00	0.00	3	60000.0	3
261	02	6.5	2	1	8.6	2	5.11	0.00	0.00	3	21000.0	3
375	02	8.0	2	1	8.6	0	0.00	0.00	0.00	3	120000.0	1
376	02	8.0	2	1	8.6	0	0.00	0.00	0.00	3	215000.0	1
377	02	8.0	2	1	8.6	0	0.00	0.00	0.00	3	180000.0	1
378	02	8.0	2	1	8.6	0	0.00	0.00	0.00	3	90000.0	1
379	02	8.0	2	1	8.6	1	1.38	0.00	0.00	3	175000.0	1
380	02	8.0	2	1	8.6	1	1.83	0.00	0.00	3	330000.0	1
381	02	8.0	2	1	8.6	1	1.47	0.00	0.00	3	115000.0	1
382	02	8.0	2	1	8.6	1	1.47	0.00	0.00	3	84000.0	1
383	02	8.0	2	1	8.6	2	1.73	0.00	0.00	3	225000.0	1
384	02	8.0	2	1	8.6	2	1.57	0.00	0.00	3	81000.0	1
385	02	8.0	2	1	8.6	2	1.30	0.00	0.00	3	147000.0	1
386	02	8.0	2	1	8.6	2	1.29	0.00	0.00	3	600000.0	1
271	02	6.5	2	2	8.6	0	0.00	0.00	0.00	2	59.2	1
272	02	6.5	2	2	8.6	0	0.00	0.00	0.00	2	68.4	1
273	02	6.5	2	2	8.6	0	0.00	0.00	0.00	2	58.9	1
274	02	6.5	2	2	8.6	0	0.00	0.00	0.00	2	63.2	1
275	02	6.5	2	2	8.6	1	7.95	0.00	0.00	2	25.5	2
276	02	6.5	2	2	8.6	1	5.22	0.00	0.00	2	40.2	2
277	02	6.5	2	2	8.6	1	4.64	0.00	0.00	2	46.4	2
278	02	6.5	2	2	8.6	1	3.72	0.00	0.00	2	42.5	2
279	02	6.5	2	2	8.6	2	5.66	0.00	0.00	2	18.5	4
280	02	6.5	2	2	8.6	2	4.17	0.00	0.00	2	24.9	4
281	02	6.5	2	2	8.6	2	5.13	0.00	0.00	2	11.8	4
282	02	6.5	2	2	8.6	2	3.56	0.00	0.00	2	31.2	4
396	02	8.0	2	2	8.6	0	0.00	0.00	0.00	2	77.4	1
397	02	8.0	2	2	8.6	0	0.00	0.00	0.00	2	66.9	1
398	02	8.0	2	2	8.6	0	0.00	0.00	0.00	2	77.5	1
399	02	8.0	2	2	8.6	0	0.00	0.00	0.00	2	76.6	1
400	02	8.0	2	2	8.6	1	1.32	0.00	0.00	2	69.0	1
401	02	8.0	2	2	8.6	1	0.96	0.00	0.00	2	70.8	1
402	02	8.0	2	2	8.6	1	0.00	0.00	0.00	2	75.4	1
403	02	8.0	2	2	8.6	1	0.00	0.00	0.00	2	65.6	1
404	02	8.0	2	2	8.6	2	0.95	0.00	0.00	2	42.0	1
405	02	8.0	2	2	8.6	2	1.05	0.00	0.00	2	35.9	1
406	02	8.0	2	2	8.6	2	0.00	0.00	0.00	2	35.6	1
407	02	8.0	2	2	8.6	2	0.00	0.00	0.00	2	33.7	1
271	02	6.5	2	2	8.6	0	0.00	0.00	0.00	3	100000.0	1
272	02	6.5	2	2	8.6	0	0.00	0.00	0.00	3	180000.0	1
273	02	6.5	2	2	8.6	0	0.00	0.00	0.00	3	150000.0	1

'E' MODULUS RESEARCH DATA CORRELATION

SAMPLE NO.	SOURCE CODE	ASPHALT CONTENT %	SRC	FIL	200M	TRT	PERMEABLE VOIDS	MARSHALL VOIDS	DENSITY	CMP	STRESS LEVEL	STR
274	02	6.5	2	2	8.6	0	0.00	0.00	0.00	3	145000.0	1
275	02	6.5	2	2	8.6	1	7.95	0.00	0.00	3	54000.0	2
276	02	6.5	2	2	8.6	1	5.22	0.00	0.00	3	67000.0	2
277	02	6.5	2	2	8.6	1	4.64	0.00	0.00	3	80000.0	2
278	02	6.5	2	2	8.6	1	3.72	0.00	0.00	3	122000.0	2
279	02	6.5	2	2	8.6	2	5.66	0.00	0.00	3	17000.0	4
280	02	6.5	2	2	8.6	2	4.17	0.00	0.00	3	74000.0	4
281	02	6.5	2	2	8.6	2	5.13	0.00	0.00	3	10000.0	4
282	02	6.5	2	2	8.6	2	3.56	0.00	0.00	3	21000.0	4
396	02	8.0	2	2	8.6	0	0.00	0.00	0.00	3	105000.0	1
397	02	8.0	2	2	8.6	0	0.00	0.00	0.00	3	110000.0	1
398	02	8.0	2	2	8.6	0	0.00	0.00	0.00	3	178000.0	1
399	02	8.0	2	2	8.6	0	0.00	0.00	0.00	3	130000.0	1
400	02	8.0	2	2	8.6	1	1.32	0.00	0.00	3	100000.0	1
401	02	8.0	2	2	8.6	1	0.96	0.00	0.00	3	109000.0	1
402	02	8.0	2	2	8.6	1	0.00	0.00	0.00	3	105000.0	1
403	02	8.0	2	2	8.6	1	0.00	0.00	0.00	3	68000.0	1
404	02	8.0	2	2	8.6	2	0.95	0.00	0.00	3	84000.0	1
405	02	8.0	2	2	8.6	2	1.05	0.00	0.00	3	42500.0	1
406	02	8.0	2	2	8.6	2	0.00	0.00	0.00	3	13200.0	1
407	02	8.0	2	2	8.6	2	0.00	0.00	0.00	3	42000.0	1
417	02	8.0	2	3	8.6	0	0.00	0.00	0.00	2	68.0	1
418	02	8.0	2	3	8.6	0	0.00	0.00	0.00	2	72.3	1
419	02	8.0	2	3	8.6	0	0.00	0.00	0.00	2	79.6	1
420	02	8.0	2	3	8.6	0	0.00	0.00	0.00	2	82.3	1
421	02	8.0	2	3	8.6	1	0.62	0.00	0.00	2	56.6	1
422	02	8.0	2	3	8.6	1	0.61	0.00	0.00	2	51.1	1
423	02	8.0	2	3	8.6	1	0.00	0.00	0.00	2	52.3	1
424	02	8.0	2	3	8.6	1	0.00	0.00	0.00	2	45.0	1
425	02	8.0	2	3	8.6	2	0.70	0.00	0.00	2	44.5	1
426	02	8.0	2	3	8.6	2	0.66	0.00	0.00	2	44.2	1
427	02	8.0	2	3	8.6	2	0.00	0.00	0.00	2	52.3	1
428	02	8.0	2	3	8.6	2	0.00	0.00	0.00	2	47.7	1
417	02	8.0	2	3	8.6	0	0.00	0.00	0.00	3	158000.0	1
418	02	8.0	2	3	8.6	0	0.00	0.00	0.00	3	147000.0	1
419	02	8.0	2	3	8.6	0	0.00	0.00	0.00	3	87000.0	1
420	02	8.0	2	3	8.6	0	0.00	0.00	0.00	3	100000.0	1
421	02	8.0	2	3	8.6	1	0.62	0.00	0.00	3	98000.0	1
422	02	8.0	2	3	8.6	1	0.61	0.00	0.00	3	118000.0	1
423	02	8.0	2	3	8.6	1	0.00	0.00	0.00	3	160000.0	1
424	02	8.0	2	3	8.6	1	0.00	0.00	0.00	3	100000.0	1
425	02	8.0	2	3	8.6	2	0.70	0.00	0.00	3	73000.0	1
426	02	8.0	2	3	8.6	2	0.66	0.00	0.00	3	72000.0	1
427	02	8.0	2	3	8.6	2	0.00	0.00	0.00	3	70000.0	1
428	02	8.0	2	3	8.6	2	0.00	0.00	0.00	3	181000.0	1

'E' MODULUS RESEARCH DATA CORRELATION

SAMPLE NO.	SOURCE CODE	ASPHALT CONTENT %	SRC	FIL	200M.	TRT	PERMEABLE VOIDS	MARSHALL VOIDS	DENSITY	CMP	STRESS LEVEL	STR
438	03	6.5	2	0	6.9	0	0.00	0.00	0.00	2	81.3	1
439	03	6.5	2	0	6.9	0	0.00	0.00	0.00	2	80.3	1
440	03	6.5	2	0	6.9	0	0.00	0.00	0.00	2	88.1	1
441	03	6.5	2	0	6.9	0	0.00	0.00	0.00	2	74.9	1
442	03	6.5	2	0	6.9	1	0.00	0.00	0.00	2	58.0	1
443	03	6.5	2	0	6.9	1	0.00	0.00	0.00	2	63.0	1
444	03	6.5	2	0	6.9	1	0.00	0.00	0.00	2	68.3	1
445	03	6.5	2	0	6.9	1	0.00	0.00	0.00	2	67.6	1
446	03	6.5	2	0	6.9	2	0.31	0.00	0.00	2	70.2	1
438	03	6.5	2	0	6.9	0	0.00	0.00	0.00	3	84000.0	1
439	03	6.5	2	0	6.9	0	0.00	0.00	0.00	3	114000.0	1
440	03	6.5	2	0	6.9	0	0.00	0.00	0.00	3	125000.0	1
441	03	6.5	2	0	6.9	0	0.00	0.00	0.00	3	83000.0	1
442	03	6.5	2	0	6.9	1	0.00	0.00	0.00	3	30000.0	1
443	03	6.5	2	0	6.9	1	0.00	0.00	0.00	3	34000.0	1
444	03	6.5	2	0	6.9	1	0.00	0.00	0.00	3	48000.0	1
445	03	6.5	2	0	6.9	1	0.00	0.00	0.00	3	47000.0	1
446	03	6.5	2	0	6.9	2	0.31	0.00	0.00	3	66000.6	1
459	03	6.5	2	1	6.9	0	0.00	0.00	0.00	2	76.0	1
460	03	6.5	2	1	6.9	0	0.00	0.00	0.00	2	80.0	1
461	03	6.5	2	1	6.9	0	0.00	0.00	0.00	2	73.8	1
462	03	6.5	2	1	6.9	2	0.00	0.00	0.00	2	76.4	1
463	03	6.5	2	1	6.9	1	0.00	0.00	0.00	2	87.5	1
464	03	6.5	2	1	6.9	1	0.00	0.00	0.00	2	87.4	1
465	03	6.5	2	1	6.9	1	0.00	0.00	0.00	2	75.0	1
466	03	6.5	2	1	6.9	1	0.00	0.00	0.00	2	83.0	1
467	03	6.5	2	1	6.9	2	0.00	0.00	0.00	2	73.8	1
468	03	6.5	2	1	6.9	2	0.00	0.00	0.00	2	72.7	1
469	03	6.5	2	1	6.9	2	0.00	0.00	0.00	2	85.2	1
470	03	6.5	2	1	6.9	2	0.00	0.00	0.00	2	73.9	1
459	03	6.5	2	1	6.9	0	0.00	0.00	0.00	3	81000.0	1
460	03	6.5	2	1	6.9	0	0.00	0.00	0.00	3	142000.0	1
461	03	6.5	2	1	6.9	0	0.00	0.00	0.00	3	105000.0	1
462	03	6.5	2	1	6.9	2	0.00	0.00	0.00	3	100000.0	1
464	03	6.5	2	1	6.9	1	0.00	0.00	0.00	3	91000.0	1
465	03	6.5	2	1	6.9	1	0.00	0.00	0.00	3	84000.0	1
466	03	6.5	2	1	6.9	1	0.00	0.00	0.00	3	98000.0	1
467	03	6.5	2	1	6.9	2	0.00	0.00	0.00	3	83000.0	1
468	03	6.5	2	1	6.9	2	0.00	0.00	0.00	3	78000.0	1
469	03	6.5	2	1	6.9	2	0.00	0.00	0.00	3	148000.0	1
470	03	6.5	2	1	6.9	2	0.00	0.00	0.00	3	102500.0	1
480	03	6.5	2	2	6.9	0	0.00	0.00	0.00	2	52.8	1
481	03	6.5	2	2	6.9	0	0.00	0.00	0.00	2	56.8	1
482	03	6.5	2	2	6.9	0	0.00	0.00	0.00	2	57.7	1
483	03	6.5	2	2	6.9	0	0.00	0.00	0.00	2	53.8	1
484	03	6.5	2	2	6.9	1	0.00	0.00	0.00	2	64.9	1
485	03	6.5	2	2	6.9	1	0.00	0.00	0.00	2	58.9	1
486	03	6.5	2	2	6.9	1	0.00	0.00	0.00	2	64.0	1
487	03	6.5	2	2	6.9	1	0.00	0.00	0.00	2	60.7	1
488	03	6.5	2	2	6.9	2	0.65	0.00	0.00	2	62.1	3
489	03	6.5	2	2	6.9	2	0.80	0.00	0.00	2	61.9	3
490	03	6.5	2	2	6.9	2	0.42	0.00	0.00	2	58.2	3
491	03	6.5	2	2	6.9	2	0.26	0.00	0.00	2	57.9	3
480	03	6.5	2	2	6.9	0	0.00	0.00	0.00	3	32000.0	1

'E' MODULUS RESEARCH DATA CORRELATION

SAMPLE NO.	SOURCE CODE	ASPHALT CONTENT %	SRC	FIL	200M	TRT	PERMEABLE VOIDS	MARSHALL VOIDS	DENSITY	CMP	STRESS LEVEL	STR
481	03	6.5	2	2	6.9	0	0.00	0.00	0.00	3	32000.0	1
482	03	6.5	2	2	6.9	0	0.00	0.00	0.00	3	42000.0	1
483	03	6.5	2	2	6.9	0	0.00	0.00	0.00	3	71000.0	1
484	03	6.5	2	2	6.9	1	0.00	0.00	0.00	3	43000.0	1
485	03	6.5	2	2	6.9	1	0.00	0.00	0.00	3	40000.0	1
486	03	6.5	2	2	6.9	1	0.00	0.00	0.00	3	50000.0	1
487	03	6.5	2	2	6.9	1	0.00	0.00	0.00	3	39500.0	1
488	03	6.5	2	2	6.9	2	0.65	0.00	0.00	3	39000.0	3
489	03	6.5	2	2	6.9	2	0.80	0.00	0.00	3	53000.0	3
490	03	6.5	2	2	6.9	2	0.42	0.00	0.00	3	52000.0	3
491	03	6.5	2	2	6.9	2	0.26	0.00	0.00	3	59000.0	3
501	03	6.5	2	3	6.9	0	0.00	0.00	0.00	2	74.5	1
502	03	6.5	2	3	6.9	0	0.00	0.00	0.00	2	77.2	1
503	03	6.5	2	3	6.9	0	0.00	0.00	0.00	2	78.5	1
504	03	6.5	2	3	6.9	0	0.00	0.00	0.00	2	75.7	1
505	03	6.5	2	3	6.9	1	0.00	0.00	0.00	2	70.9	1
506	03	6.5	2	3	6.9	1	0.00	0.00	0.00	2	72.9	1
507	03	6.5	2	3	6.9	1	0.00	0.00	0.00	2	62.3	1
508	03	6.5	2	3	6.9	1	0.00	0.00	0.00	2	75.1	1
509	03	6.5	2	3	6.9	2	0.72	0.00	0.00	2	74.5	2
510	03	6.5	2	3	6.9	2	0.71	0.00	0.00	2	66.1	2
511	03	6.5	2	3	6.9	2	0.83	0.00	0.00	2	59.6	2
512	03	6.5	2	3	6.9	2	0.59	0.00	0.00	2	61.7	2
501	03	6.5	2	3	6.9	0	0.00	0.00	0.00	3	70000.0	1
502	03	6.5	2	3	6.9	0	0.00	0.00	0.00	3	62000.0	1
503	03	6.5	2	3	6.9	0	0.00	0.00	0.00	3	72000.0	1
504	03	6.5	2	3	6.9	0	0.00	0.00	0.00	3	69000.0	1
505	03	6.5	2	3	6.9	1	0.00	0.00	0.00	3	75000.0	1
506	03	6.5	2	3	6.9	1	0.00	0.00	0.00	3	59000.0	1
507	03	6.5	2	3	6.9	1	0.00	0.00	0.00	3	44000.0	1
509	03	6.5	2	3	6.9	2	0.72	0.00	0.00	3	58000.0	2
510	03	6.5	2	3	6.9	2	0.71	0.00	0.00	3	66000.0	2
511	03	6.5	2	3	6.9	2	0.83	0.00	0.00	3	30500.0	2
512	03	6.5	2	3	6.9	2	0.59	0.00	0.00	3	56000.0	2

'E' MODULUS RESEARCH DATA CORRELATION

SAMPLE NO.	SOURCE CODE	ASPHALT CONTENT %	S R C	F I L	200M	T R T	PERMEABLE VOIDS	MARSHALL VOIDS	DENSITY	CMP	STRESS LEVEL	STR
522	04	6.2	2	0	4.6	0	0.00	0.00	0.00	2	62.5	1
523	04	6.2	2	0	4.6	0	0.00	0.00	0.00	2	65.3	1
524	04	6.2	2	0	4.6	0	0.00	0.00	0.00	2	47.5	1
525	04	6.2	2	0	4.6	0	0.00	0.00	0.00	2	68.2	1
526	04	6.2	2	0	4.6	1	0.00	0.00	0.00	2	57.0	1
527	04	6.2	2	0	4.6	1	0.00	0.00	0.00	2	61.9	1
528	04	6.2	2	0	4.6	1	0.00	0.00	0.00	2	66.7	1
529	04	6.2	2	0	4.6	1	0.00	0.00	0.00	2	59.2	1
530	04	6.2	2	0	4.6	2	2.24	0.00	0.00	2	62.9	1
531	04	6.2	2	0	4.6	2	1.67	0.00	0.00	2	59.8	1
532	04	6.2	2	0	4.6	2	1.62	0.00	0.00	2	71.7	1
533	04	6.2	2	0	4.6	2	1.85	0.00	0.00	2	58.6	1
537	04	5.7	2	0	4.6	0	0.00	0.00	0.00	2	65.4	1
538	04	5.7	2	0	4.6	0	0.00	0.00	0.00	2	71.4	1
539	04	5.7	2	0	4.6	0	0.00	0.00	0.00	2	65.0	1
540	04	5.7	2	0	4.6	0	0.00	0.00	0.00	2	53.1	1
541	04	5.7	2	0	4.6	1	0.00	0.00	0.00	2	44.4	1
542	04	5.7	2	0	4.6	1	0.00	0.00	0.00	2	55.3	1
543	04	5.7	2	0	4.6	1	0.00	0.00	0.00	2	48.4	1
544	04	5.7	2	0	4.6	1	0.00	0.00	0.00	2	53.7	1
545	04	5.7	2	0	4.6	2	5.17	0.00	0.00	2	29.9	4
546	04	5.7	2	0	4.6	2	4.35	0.00	0.00	2	30.8	4
547	04	5.7	2	0	4.6	2	4.25	0.00	0.00	2	32.2	4
548	04	5.7	2	0	4.6	2	4.80	0.00	0.00	2	36.9	4
705	04	6.2	2	0	4.6	0	0.00	0.00	0.00	2	65.9	1
706	04	6.2	2	0	4.6	0	0.00	0.00	0.00	2	41.5	1
707	04	6.2	2	0	4.6	0	0.00	0.00	0.00	2	45.2	1
708	04	6.2	2	0	4.6	0	0.00	0.00	0.00	2	38.0	1
709	04	6.2	2	0	4.6	1	9.73	0.00	0.00	2	31.7	3
710	04	6.2	2	0	4.6	1	9.75	0.00	0.00	2	45.7	3
711	04	6.2	2	0	4.6	1	9.99	0.00	0.00	2	27.6	3
712	04	6.2	2	0	4.6	1	9.22	0.00	0.00	2	32.6	3
713	04	6.2	2	0	4.6	2	0.00	0.00	0.00	2	2000003.4	2
714	04	6.2	2	0	4.6	2	0.00	0.00	0.00	2	38.5	2
715	04	6.2	2	0	4.6	2	0.00	0.00	0.00	2	41.8	2
726	04	5.9	2	0	4.6	0	0.00	0.00	0.00	2	49.5	1
727	04	5.9	2	0	4.6	0	0.00	0.00	0.00	2	60.0	1
728	04	5.9	2	0	4.6	0	0.00	0.00	0.00	2	55.3	1
729	04	5.9	2	0	4.6	0	0.00	0.00	0.00	2	58.7	1
730	04	5.9	2	0	4.6	1	0.00	0.00	0.00	2	28.9	2
731	04	5.9	2	0	4.6	1	0.00	0.00	0.00	2	45.1	2
732	04	5.9	2	0	4.6	1	0.00	0.00	0.00	2	34.4	2
733	04	5.9	2	0	4.6	1	0.00	0.00	0.00	2	34.5	2
734	04	5.9	2	0	4.6	2	3.54	0.00	0.00	2	30.2	4
735	04	5.9	2	0	4.6	2	3.12	0.00	0.00	2	34.6	4
736	04	5.9	2	0	4.6	2	3.87	0.00	0.00	2	27.4	4
737	04	5.9	2	0	4.6	2	3.12	0.00	0.00	2	36.2	4
741	04	6.2	1	0	4.6	2	4.69	0.00	0.00	2	26.7	3
742	04	6.2	1	0	4.6	2	2.44	0.00	0.00	2	42.9	3
743	04	6.2	1	0	4.6	2	4.37	0.00	0.00	2	31.1	3
744	04	6.2	1	0	4.6	2	3.31	0.00	0.00	2	40.7	3
745	04	6.2	1	0	4.6	1	0.00	0.00	0.00	2	58.3	2
746	04	6.2	1	0	4.6	1	0.00	0.00	0.00	2	48.4	2
747	04	6.2	1	0	4.6	1	0.00	0.00	0.00	2	44.8	2

'E' MODULUS RESEARCH DATA CORRELATION

SAMPLE NO.	SOURCE CODE	ASPHALT CONTENT %	SRC	FIL	200M	TRT	PERMEABLE VOIDS	MARSHALL VOIDS	DENSITY	CMP	STRESS LEVEL	STR
748	04	6.2	1	0	4.6	1	0.00	0.00	0.00	2	43.8	2
749	04	6.2	1	0	4.6	0	0.00	0.00	0.00	2	69.8	1
750	04	6.2	1	0	4.6	0	0.00	0.00	0.00	2	65.3	1
751	04	6.2	1	0	4.6	0	0.00	0.00	0.00	2	82.2	1
752	04	6.2	1	0	4.6	0	0.00	0.00	0.00	2	66.6	1
756	04	6.2	2	0	4.6	2	3.74	0.00	0.00	2	47.2	3
757	04	6.2	2	0	4.6	2	2.64	0.00	0.00	2	50.7	3
758	04	6.2	2	0	4.6	2	2.83	0.00	0.00	2	48.4	3
759	04	6.2	2	0	4.6	2	2.63	0.00	0.00	2	43.4	3
760	04	6.2	2	0	4.6	1	0.00	0.00	0.00	2	53.2	2
761	04	6.2	2	0	4.6	1	0.00	0.00	0.00	2	58.1	2
762	04	6.2	2	0	4.6	1	0.00	0.00	0.00	2	58.6	2
763	04	6.2	2	0	4.6	1	0.00	0.00	0.00	2	54.2	2
764	04	6.2	2	0	4.6	0	0.00	0.00	0.00	2	62.7	1
765	04	6.2	2	0	4.6	0	0.00	0.00	0.00	2	62.1	1
766	04	6.2	2	0	4.6	0	0.00	0.00	0.00	2	55.9	1
767	04	6.2	2	0	4.6	0	0.00	0.00	0.00	2	67.0	1
771	04	6.2	1	0	4.6	0	0.00	0.00	0.00	2	68.3	1
772	04	6.2	1	0	4.6	0	0.00	0.00	0.00	2	63.7	1
773	04	6.2	1	0	4.6	0	0.00	0.00	0.00	2	66.7	1
774	04	6.2	1	0	4.6	0	0.00	0.00	0.00	2	64.6	1
775	04	6.2	1	0	4.6	1	3.33	0.00	0.00	2	66.1	1
776	04	6.2	1	0	4.6	1	4.13	0.00	0.00	2	59.6	1
777	04	6.2	1	0	4.6	1	3.25	0.00	0.00	2	66.5	1
778	04	6.2	1	0	4.6	1	3.99	0.00	0.00	2	57.2	1
779	04	6.2	1	0	4.6	2	3.13	0.00	0.00	2	39.5	2
780	04	6.2	1	0	4.6	2	4.74	0.00	0.00	2	38.5	2
781	04	6.2	1	0	4.6	2	3.06	0.00	0.00	2	46.3	2
782	04	6.2	1	0	4.6	2	3.42	0.00	0.00	2	49.3	2
786	04	5.5	1	0	4.6	0	0.00	0.00	0.00	2	52.8	1
787	04	5.5	1	0	4.6	0	0.00	0.00	0.00	2	54.7	1
788	04	5.5	1	0	4.6	0	0.00	0.00	0.00	2	60.0	1
789	04	5.5	1	0	4.6	0	0.00	0.00	0.00	2	55.9	1
790	04	5.5	1	0	4.6	1	0.00	0.00	0.00	2	46.5	2
791	04	5.5	1	0	4.6	1	0.00	0.00	0.00	2	52.5	2
792	04	5.5	1	0	4.6	1	0.00	0.00	0.00	2	50.0	2
793	04	5.5	1	0	4.6	1	0.00	0.00	0.00	2	41.8	2
794	04	5.5	1	0	4.6	2	5.50	0.00	0.00	2	30.0	4
795	04	5.5	1	0	4.6	2	4.86	0.00	0.00	2	36.5	4
796	04	5.5	1	0	4.6	2	4.25	0.00	0.00	2	41.8	4
797	04	5.5	1	0	4.6	2	5.49	0.00	0.00	2	31.3	4
522	04	6.2	2	0	4.6	0	0.00	0.00	0.00	3	98000.0	1
523	04	6.2	2	0	4.6	0	0.00	0.00	0.00	3	81000.0	1
524	04	6.2	2	0	4.6	0	0.00	0.00	0.00	3	52000.0	1
526	04	6.2	2	0	4.6	1	0.00	0.00	0.00	3	132000.0	1
527	04	6.2	2	0	4.6	1	0.00	0.00	0.00	3	52000.0	1
528	04	6.2	2	0	4.6	1	0.00	0.00	0.00	3	110000.0	1
529	04	6.2	2	0	4.6	1	0.00	0.00	0.00	3	66000.0	1
530	04	6.2	2	0	4.6	2	2.54	0.00	0.00	3	45500.0	1
531	04	6.2	2	0	4.6	2	1.67	0.00	0.00	3	33000.0	1
532	04	6.2	2	0	4.6	2	1.62	0.00	0.00	3	82000.0	1
533	04	6.2	2	0	4.6	2	1.85	0.00	0.00	3	46000.0	1
537	04	5.7	2	0	4.6	0	0.00	0.00	0.00	3	100000.0	1
538	04	5.7	2	0	4.6	0	0.00	0.00	0.00	3	100000.0	1

'E' MODULUS RESEARCH DATA CORRELATION

SAMPLE NO.	SOURCE CODE	ASPHALT CONTENT %	SRC	FIL	200M	TRT	PERMEABLE VOIDS	MARSHALL VOIDS	DENSITY	CMP	STRESS LEVEL	STR
594	04	6.2	2	2	4.6	2	2.74	0.00	0.00	4	317000.0	2
595	04	6.2	2	2	4.6	2	2.45	0.00	0.00	4	290000.0	2
596	04	6.2	2	2	4.6	2	0.00	0.00	0.00	4	264000.0	2
606	04	6.2	2	3	4.6	0	0.00	0.00	0.00	2	65.8	1
607	04	6.2	2	3	4.6	0	0.00	0.00	0.00	2	66.1	1
608	04	6.2	2	3	4.6	0	0.00	0.00	0.00	2	61.1	1
609	04	6.2	2	3	4.6	0	0.00	0.00	0.00	2	63.0	1
610	04	6.2	2	3	4.6	1	0.00	0.00	0.00	2	53.2	1
611	04	6.2	2	3	4.6	1	0.00	0.00	0.00	2	39.7	1
612	04	6.2	2	3	4.6	1	0.00	0.00	0.00	2	46.1	1
613	04	6.2	2	3	4.6	1	0.00	0.00	0.00	2	37.3	1
614	04	6.2	2	3	4.6	2	2.85	0.00	0.00	2	0.0	2
615	04	6.2	2	3	4.6	2	2.62	0.00	0.00	2	0.0	2
617	04	6.2	2	3	4.6	2	2.30	0.00	0.00	2	60.5	2
606	04	6.2	2	3	4.6	0	0.00	0.00	0.00	3	75000.0	1
608	04	6.2	2	3	4.6	0	0.00	0.00	0.00	3	44000.0	1
609	04	6.2	2	3	4.6	0	0.00	0.00	0.00	3	48000.0	1
610	04	6.2	2	3	4.6	1	0.00	0.00	0.00	3	39000.0	1
611	04	6.2	2	3	4.6	1	0.00	0.00	0.00	3	11000.0	1
612	04	6.2	2	3	4.6	1	0.00	0.00	0.00	3	12000.0	1
613	04	6.2	2	3	4.6	1	0.00	0.00	0.00	3	16000.0	1
614	04	6.2	2	3	4.6	2	2.85	0.00	0.00	3	34000.0	2
615	04	6.2	2	3	4.6	2	2.62	0.00	0.00	3	24000.0	2
617	04	6.2	2	3	4.6	2	2.30	0.00	0.00	3	46000.0	2
606	04	6.2	2	3	4.6	0	0.00	0.00	0.00	4	751000.0	1
607	04	6.2	2	3	4.6	0	0.00	0.00	0.00	4	810000.0	1
608	04	6.2	2	3	4.6	0	0.00	0.00	0.00	4	646000.0	1
609	04	6.2	2	3	4.6	0	0.00	0.00	0.00	4	698000.0	1
610	04	6.2	2	3	4.6	1	0.00	0.00	0.00	4	394000.0	1
611	04	6.2	2	3	4.6	1	0.00	0.00	0.00	4	240000.0	1
612	04	6.2	2	3	4.6	1	0.00	0.00	0.00	4	265000.0	1
613	04	6.2	2	3	4.6	1	0.00	0.00	0.00	4	257000.0	1
614	04	6.2	2	3	4.6	2	2.85	0.00	0.00	4	459000.0	2
615	04	6.2	2	3	4.6	2	2.62	0.00	0.00	4	385000.0	2
616	04	6.2	2	3	4.6	2	3.47	0.00	0.00	4	412000.0	2
617	04	6.2	2	3	4.6	2	2.30	0.00	0.00	4	567000.0	2

'E' MODULUS RESEARCH DATA CORRELATION

SAMPLE NO.	SOURCE CODE	ASPHALT CONTENT %	SRC	FIL	200M	TRT	PERMEABLE VOIDS	MARSHALL VOIDS	DENSITY	CMP	STRESS LEVEL	STR
575	04	6.2	2	1	4.6	2	2.42	0.00	0.00	2	62.6	1
564	04	6.2	2	1	4.6	0	0.00	0.00	0.00	3	72000.0	1
565	04	6.2	2	1	4.6	0	0.00	0.00	0.00	3	120000.0	1
567	04	6.2	2	1	4.6	0	0.00	0.00	0.00	3	83000.0	1
568	04	6.2	2	1	4.6	1	0.00	0.00	0.00	3	59000.0	1
569	04	6.2	2	1	4.6	1	0.00	0.00	0.00	3	128000.0	1
572	04	6.2	2	1	4.6	2	2.22	0.00	0.00	3	62000.0	1
573	04	6.2	2	1	4.6	2	1.98	0.00	0.00	3	51000.0	1
574	04	6.2	2	1	4.6	2	1.55	0.00	0.00	3	27000.0	1
575	04	6.2	2	1	4.6	2	2.42	0.00	0.00	3	51000.0	1
564	04	6.2	2	1	4.6	0	0.00	0.00	0.00	4	781000.0	1
565	04	6.2	2	1	4.6	0	0.00	0.00	0.00	4	723000.0	1
566	04	6.2	2	1	4.6	0	0.00	0.00	0.00	4	783000.0	1
567	04	6.2	2	1	4.6	0	0.00	0.00	0.00	4	781000.0	1
568	04	6.2	2	1	4.6	1	0.00	0.00	0.00	4	568000.0	1
569	04	6.2	2	1	4.6	1	0.00	0.00	0.00	4	677000.0	1
570	04	6.2	2	1	4.6	1	0.00	0.00	0.00	4	781000.0	1
571	04	6.2	2	1	4.6	1	0.00	0.00	0.00	4	677000.0	1
572	04	6.2	2	1	4.6	2	2.22	0.00	0.00	4	613000.0	1
573	04	6.2	2	1	4.6	2	1.98	0.00	0.00	4	579000.0	1
574	04	6.2	2	1	4.6	2	1.55	0.00	0.00	4	547000.0	1
575	04	6.2	2	1	4.6	2	2.42	0.00	0.00	4	684000.0	1
585	04	6.2	2	2	4.6	0	0.00	0.00	0.00	2	59.4	1
586	04	6.2	2	2	4.6	0	0.00	0.00	0.00	2	62.3	1
587	04	6.2	2	2	4.6	0	0.00	0.00	0.00	2	65.2	1
588	04	6.2	2	2	4.6	0	0.00	0.00	0.00	2	57.8	1
589	04	6.2	2	2	4.6	1	0.00	0.00	0.00	2	60.1	1
590	04	6.2	2	2	4.6	1	0.00	0.00	0.00	2	44.2	1
591	04	6.2	2	2	4.6	1	0.00	0.00	0.00	2	52.9	1
592	04	6.2	2	2	4.6	1	0.00	0.00	0.00	2	61.0	1
593	04	6.2	2	2	4.6	2	2.55	0.00	0.00	2	41.8	2
594	04	6.2	2	2	4.6	2	2.74	0.00	0.00	2	50.3	2
595	04	6.2	2	2	4.6	2	2.45	0.00	0.00	2	51.8	2
596	04	6.2	2	2	4.6	2	0.00	0.00	0.00	2	47.9	2
585	04	6.2	2	2	4.6	0	0.00	0.00	0.00	3	98000.0	1
586	04	6.2	2	2	4.6	0	0.00	0.00	0.00	3	64000.0	1
587	04	6.2	2	2	4.6	0	0.00	0.00	0.00	3	42500.0	1
588	04	6.2	2	2	4.6	0	0.00	0.00	0.00	3	48000.0	1
589	04	6.2	2	2	4.6	1	0.00	0.00	0.00	3	29000.0	1
590	04	6.2	2	2	4.6	1	0.00	0.00	0.00	3	19000.0	1
591	04	6.2	2	2	4.6	1	0.00	0.00	0.00	3	16500.0	1
592	04	6.2	2	2	4.6	1	0.00	0.00	0.00	3	9800.0	1
593	04	6.2	2	2	4.6	2	2.55	0.00	0.00	3	18000.0	2
594	04	6.2	2	2	4.6	2	2.74	0.00	0.00	3	16000.0	2
595	04	6.2	2	2	4.6	2	2.45	0.00	0.00	3	28000.0	2
596	04	6.2	2	2	4.6	2	0.00	0.00	0.00	3	17000.0	2
585	04	6.2	2	2	4.6	0	0.00	0.00	0.00	4	582000.0	1
586	04	6.2	2	2	4.6	0	0.00	0.00	0.00	4	522000.0	1
587	04	6.2	2	2	4.6	0	0.00	0.00	0.00	4	536000.0	1
589	04	6.2	2	2	4.6	1	0.00	0.00	0.00	4	462000.0	1
590	04	6.2	2	2	4.6	1	0.00	0.00	0.00	4	410000.0	1
591	04	6.2	2	2	4.6	1	0.00	0.00	0.00	4	352000.0	1
592	04	6.2	2	2	4.6	1	0.00	0.00	0.00	4	355000.0	1
593	04	6.2	2	2	4.6	2	2.55	0.00	0.00	4	267000.0	2

'E' MODULUS RESEARCH DATA CORRELATION

SAMPLE NO.	SOURCE CODE	ASPHALT CONTENT %	SRC	FIL	200M	TRT	PERMEABLE VOIDS	MARSHALL VOIDS	DENSITY	CMP	STRESS LEVEL	STR
745	04	6.2	1	0	4.6	0	0.00	0.00	0.00	4	590000.0	2
746	04	6.2	1	0	4.6	1	0.00	0.00	0.00	4	634000.0	2
747	04	6.2	1	0	4.6	1	0.00	0.00	0.00	4	591000.0	2
748	04	6.2	1	0	4.6	1	0.00	0.00	0.00	4	634000.0	2
749	04	6.2	1	0	4.6	0	0.00	0.00	0.00	4	1043000.0	1
750	04	6.2	1	0	4.6	0	0.00	0.00	0.00	4	1396000.0	1
752	04	6.2	1	0	4.6	0	0.00	0.00	0.00	4	1669000.0	1
756	04	6.2	2	0	4.6	2	3.74	0.00	0.00	4	489000.0	3
757	04	6.2	2	0	4.6	2	2.64	0.00	0.00	4	583000.0	3
758	04	6.2	2	0	4.6	2	2.83	0.00	0.00	4	670000.0	3
759	04	6.2	2	0	4.6	2	2.63	0.00	0.00	4	429000.0	3
760	04	6.2	2	0	4.6	1	0.00	0.00	0.00	4	591000.0	2
761	04	6.2	2	0	4.6	1	0.00	0.00	0.00	4	507000.0	2
762	04	6.2	2	0	4.6	1	0.00	0.00	0.00	4	626000.0	2
763	04	6.2	2	0	4.6	1	0.00	0.00	0.00	4	588000.0	2
764	04	6.2	2	0	4.6	0	0.00	0.00	0.00	4	1093000.0	1
765	04	6.2	2	0	4.6	0	0.00	0.00	0.00	4	1256000.0	1
766	04	6.2	2	0	4.6	0	0.00	0.00	0.00	4	718000.0	1
767	04	6.2	2	0	4.6	0	0.00	0.00	0.00	4	802000.0	1
771	04	6.2	1	0	4.6	0	0.00	0.00	0.00	4	1365000.0	1
772	04	6.2	1	0	4.6	0	0.00	0.00	0.00	4	1352000.0	1
773	04	6.2	1	0	4.6	0	0.00	0.00	0.00	4	1352000.0	1
774	04	6.2	1	0	4.6	0	0.00	0.00	0.00	4	1147000.0	1
775	04	6.2	1	0	4.6	1	3.33	0.00	0.00	4	1060000.0	1
776	04	6.2	1	0	4.6	1	4.13	0.00	0.00	4	822000.0	1
777	04	6.2	1	0	4.6	1	3.25	0.00	0.00	4	1020000.0	1
778	04	6.2	1	0	4.6	1	3.99	0.00	0.00	4	997000.0	1
779	04	6.2	1	0	4.6	2	3.13	0.00	0.00	4	586000.0	2
780	04	6.2	1	0	4.6	2	4.74	0.00	0.00	4	586000.0	2
781	04	6.2	1	0	4.6	2	3.06	0.00	0.00	4	794000.0	2
782	04	6.2	1	0	4.6	2	3.42	0.00	0.00	4	869000.0	2
786	04	5.5	1	0	4.6	0	0.00	0.00	0.00	4	986000.0	1
787	04	5.5	1	0	4.6	0	0.00	0.00	0.00	4	1105000.0	1
788	04	5.5	1	0	4.6	0	0.00	0.00	0.00	4	1110000.0	1
789	04	5.5	1	0	4.6	0	0.00	0.00	0.00	4	983000.0	1
790	04	5.5	1	0	4.6	1	0.00	0.00	0.00	4	692000.0	2
791	04	5.5	1	0	4.6	1	0.00	0.00	0.00	4	1087000.0	2
792	04	5.5	1	0	4.6	1	0.00	0.00	0.00	4	793000.0	2
793	04	5.5	1	0	4.6	1	0.00	0.00	0.00	4	516000.0	2
794	04	5.5	1	0	4.6	2	5.50	0.00	0.00	4	477000.0	4
795	04	5.5	1	0	4.6	2	4.86	0.00	0.00	4	431000.0	4
796	04	5.5	1	0	4.6	2	4.25	0.00	0.00	4	612000.0	4
797	04	5.5	1	0	4.6	2	5.49	0.00	0.00	4	390000.0	4
564	04	6.2	2	1	4.6	0	0.00	0.00	0.00	2	71.5	1
565	04	6.2	2	1	4.6	0	0.00	0.00	0.00	2	64.5	1
566	04	6.2	2	1	4.6	0	0.00	0.00	0.00	2	65.2	1
567	04	6.2	2	1	4.6	0	0.00	0.00	0.00	2	67.4	1
568	04	6.2	2	1	4.6	1	0.00	0.00	0.00	2	61.7	1
569	04	6.2	2	1	4.6	1	0.00	0.00	0.00	2	61.9	1
570	04	6.2	2	1	4.6	1	0.00	0.00	0.00	2	67.2	1
571	04	6.2	2	1	4.6	1	0.00	0.00	0.00	2	63.6	1
572	04	6.2	2	1	4.6	2	2.22	0.00	0.00	2	62.9	1
573	04	6.2	2	1	4.6	2	1.98	0.00	0.00	2	64.3	1
574	04	6.2	2	1	4.6	2	1.54	0.00	0.00	2	61.1	1

'E' MODULUS RESEARCH DATA CORRELATION

SAMPLE NO.	SOURCE CODE	ASPHALT CONTENT %	SRC	FIL	200M	TRT	PERMEABLE VOIDS	MARSHALL VOIDS	DENSITY	CMP	STRESS LEVEL	STR
765	04	6.2	2	0	4.6	0	0.00	0.00	0.00	3	80000.0	1
766	04	6.2	2	0	4.6	0	0.00	0.00	0.00	3	62000.0	1
767	04	6.2	2	0	4.6	0	0.00	0.00	0.00	3	94000.0	1
771	04	6.2	1	0	4.6	0	0.00	0.00	0.00	3	210000.0	1
772	04	6.2	1	0	4.6	0	0.00	0.00	0.00	3	90000.0	1
773	04	6.2	1	0	4.6	0	0.00	0.00	0.00	3	1100000.0	1
774	04	6.2	1	0	4.6	0	0.00	0.00	0.00	3	96000.0	1
775	04	6.2	1	0	4.6	1	3.33	0.00	0.00	3	72000.0	1
776	04	6.2	1	0	4.6	1	4.13	0.00	0.00	3	48000.0	1
777	04	6.2	1	0	4.6	1	3.25	0.00	0.00	3	54000.0	1
778	04	6.2	1	0	4.6	1	3.99	0.00	0.00	3	64000.0	1
779	04	6.2	1	0	4.6	2	3.13	0.00	0.00	3	33000.0	2
780	04	6.2	1	0	4.6	2	4.74	0.00	0.00	3	38000.0	2
781	04	6.2	1	0	4.6	2	3.06	0.00	0.00	3	40000.0	2
782	04	6.2	1	0	4.6	2	3.42	0.00	0.00	3	31000.0	2
786	04	5.5	1	0	4.6	0	0.00	0.00	0.00	3	38000.0	1
787	04	5.5	1	0	4.6	0	0.00	0.00	0.00	3	120000.0	1
788	04	5.5	1	0	4.6	0	0.00	0.00	0.00	3	94000.0	1
789	04	5.5	1	0	4.6	0	0.00	0.00	0.00	3	46000.0	1
790	04	5.5	1	0	4.6	1	0.00	0.00	0.00	3	40000.0	2
791	04	5.5	1	0	4.6	1	0.00	0.00	0.00	3	90000.0	2
792	04	5.5	1	0	4.6	1	0.00	0.00	0.00	3	60000.0	2
793	04	5.5	1	0	4.6	1	0.00	0.00	0.00	3	43000.0	2
794	04	5.5	1	0	4.6	2	5.50	0.00	0.00	3	35000.0	4
795	04	5.5	1	0	4.6	2	4.86	0.00	0.00	3	36000.0	4
796	04	5.5	1	0	4.6	2	4.25	0.00	0.00	3	52000.0	4
797	04	5.5	1	0	4.6	2	5.49	0.00	0.00	3	31000.0	4
705	04	6.2	2	0	4.6	0	0.00	0.00	0.00	4	622000.0	1
706	04	6.2	2	0	4.6	0	0.00	0.00	0.00	4	427000.0	1
707	04	6.2	2	0	4.6	0	0.00	0.00	0.00	4	450000.0	1
708	04	6.2	2	0	4.6	0	0.00	0.00	0.00	4	553000.0	1
709	04	6.2	2	0	4.6	1	9.73	0.00	0.00	4	271000.0	3
710	04	6.2	2	0	4.6	1	9.75	0.00	0.00	4	288000.0	3
711	04	6.2	2	0	4.6	1	9.99	0.00	0.00	4	271000.0	3
712	04	6.2	2	0	4.6	1	9.22	0.00	0.00	4	236000.0	3
713	04	6.2	2	0	4.6	2	0.00	0.00	0.00	4	313000.0	2
714	04	6.2	2	0	4.6	2	0.00	0.00	0.00	4	465000.0	2
715	04	6.2	2	0	4.6	2	0.00	0.00	0.00	4	355000.0	2
726	04	5.9	2	0	4.6	0	0.00	0.00	0.00	4	604000.0	1
727	04	5.9	2	0	4.6	0	0.00	0.00	0.00	4	750000.0	1
728	04	5.9	2	0	4.6	0	0.00	0.00	0.00	4	797000.0	1
729	04	5.9	2	0	4.6	0	0.00	0.00	0.00	4	503000.0	1
730	04	5.9	2	0	4.6	1	0.00	0.00	0.00	4	219000.0	2
731	04	5.9	2	0	4.6	1	0.00	0.00	0.00	4	434000.0	2
732	04	5.9	2	0	4.6	1	0.00	0.00	0.00	4	260000.0	2
733	04	5.9	2	0	4.6	1	0.00	0.00	0.00	4	349000.0	2
734	04	5.9	2	0	4.6	2	3.54	0.00	0.00	4	331000.0	4
735	04	5.9	2	0	4.6	2	3.12	0.00	0.00	4	310000.0	4
736	04	5.9	2	0	4.6	2	3.87	0.00	0.00	4	259000.0	4
737	04	5.9	2	0	4.6	2	3.12	0.00	0.00	4	394000.0	4
741	04	6.2	1	0	4.6	2	4.69	0.00	0.00	4	314000.0	3
742	04	6.2	1	0	4.6	2	2.44	0.00	0.00	4	648000.0	3
743	04	6.2	1	0	4.6	2	4.37	0.00	0.00	4	510000.0	3
744	04	6.2	1	0	4.6	2	3.31	0.00	0.00	4	563000.0	3

'E' MODULUS RESEARCH DATA CORRELATION

SAMPLE NO.	SOURCE CODE	ASPHALT CONTENT %	SRC	FIL	200M	TRT	PERMEABLE VOIDS	MARSHALL VOIDS	DENSITY	CMP	STRESS LEVEL	STR
539	04	5.7	2	0	4.6	0	0.00	0.00	0.00	3	100000.0	1
540	04	5.7	2	0	4.6	0	0.00	0.00	0.00	3	57000.0	1
541	04	5.7	2	0	4.6	1	0.00	0.00	0.00	3	32500.0	1
542	04	5.7	2	0	4.6	1	0.00	0.00	0.00	3	85000.0	1
543	04	5.7	2	0	4.6	1	0.00	0.00	0.00	3	39000.0	1
544	04	5.7	2	0	4.6	1	0.00	0.00	0.00	3	65000.0	1
545	04	5.7	2	0	4.6	2	5.17	0.00	0.00	3	36500.0	4
546	04	5.7	2	0	4.6	2	4.35	0.00	0.00	3	27500.0	4
547	04	5.7	2	0	4.6	2	4.25	0.00	0.00	3	36500.0	4
548	04	5.7	2	0	4.6	2	4.80	0.00	0.00	3	28000.0	4
705	04	6.2	2	0	4.6	0	0.00	0.00	0.00	3	110000.0	1
706	04	6.2	2	0	4.6	0	0.00	0.00	0.00	3	42000.0	1
707	04	6.2	2	0	4.6	0	0.00	0.00	0.00	3	45500.0	1
708	04	6.2	2	0	4.6	0	0.00	0.00	0.00	3	100000.0	1
709	04	6.2	2	0	4.6	1	9.73	0.00	0.00	3	23500.0	3
710	04	6.2	2	0	4.6	1	9.75	0.00	0.00	3	37000.0	3
711	04	6.2	2	0	4.6	1	9.99	0.00	0.00	3	27500.0	3
712	04	6.2	2	0	4.6	1	9.22	0.00	0.00	3	22000.0	3
713	04	6.2	2	0	4.6	2	0.00	0.00	0.00	3	15500.0	2
714	04	6.2	2	0	4.6	2	0.00	0.00	0.00	3	36000.0	2
715	04	6.2	2	0	4.6	2	0.00	0.00	0.00	3	39500.0	2
726	04	5.9	2	0	4.6	0	0.00	0.00	0.00	3	32500.0	1
727	04	5.9	2	0	4.6	0	0.00	0.00	0.00	3	72000.0	1
728	04	5.9	2	0	4.6	0	0.00	0.00	0.00	3	63000.0	1
729	04	5.9	2	0	4.6	0	0.00	0.00	0.00	3	39000.0	1
730	04	5.9	2	0	4.6	1	0.00	0.00	0.00	3	14500.0	2
731	04	5.9	2	0	4.6	1	0.00	0.00	0.00	3	22000.0	2
732	04	5.9	2	0	4.6	1	0.00	0.00	0.00	3	16500.0	2
733	04	5.9	2	0	4.6	1	0.00	0.00	0.00	3	32500.0	2
734	04	5.9	2	0	4.6	2	3.54	0.00	0.00	3	12000.0	4
735	04	5.9	2	0	4.6	2	3.12	0.00	0.00	3	16500.0	4
736	04	5.9	2	0	4.6	2	3.87	0.00	0.00	3	17000.0	4
737	04	5.9	2	0	4.6	2	3.12	0.00	0.00	3	29500.0	4
741	04	6.2	1	0	4.6	2	4.69	0.00	0.00	3	23000.0	3
742	04	6.2	1	0	4.6	2	2.44	0.00	0.00	3	25000.0	3
743	04	6.2	1	0	4.6	2	4.37	0.00	0.00	3	31000.0	3
744	04	6.2	1	0	4.6	2	3.31	0.00	0.00	3	21000.0	3
745	04	6.2	1	0	4.6	1	0.00	0.00	0.00	3	26000.0	2
746	04	6.2	1	0	4.6	1	0.00	0.00	0.00	3	44000.0	2
747	04	6.2	1	0	4.6	1	0.00	0.00	0.00	3	19000.0	2
748	04	6.2	1	0	4.6	1	0.00	0.00	0.00	3	27000.0	2
749	04	6.2	1	0	4.6	0	0.00	0.00	0.00	3	60000.0	1
750	04	6.2	1	0	4.6	0	0.00	0.00	0.00	3	54000.0	1
751	04	6.2	1	0	4.6	0	0.00	0.00	0.00	3	72000.0	1
752	04	6.2	1	0	4.6	0	0.00	0.00	0.00	3	170000.0	1
756	04	6.2	2	0	4.6	2	3.74	0.00	0.00	3	19000.0	3
757	04	6.2	2	0	4.6	2	2.64	0.00	0.00	3	19000.0	3
758	04	6.2	2	0	4.6	2	2.83	0.00	0.00	3	38000.0	3
759	04	6.2	2	0	4.6	2	2.63	0.00	0.00	3	19000.0	3
760	04	6.2	2	0	4.6	1	0.00	0.00	0.00	3	21000.0	2
761	04	6.2	2	0	4.6	1	0.00	0.00	0.00	3	41000.0	2
762	04	6.2	2	0	4.6	1	0.00	0.00	0.00	3	44000.0	2
763	04	6.2	2	0	4.6	1	0.00	0.00	0.00	3	29000.0	2
764	04	6.2	2	0	4.6	0	0.00	0.00	0.00	3	76000.0	1

'E' MODULUS RESEARCH DATA CORRELATION

SAMPLE NO.	SOURCE CODE	ASPHALT CONTENT %	SRC	FIL	200M	TRT	PERMEABLE VOIDS	MARSHALL VOIDS	DENSITY	CMP	STRESS LEVEL	STR
627	05	8.5	1	0	8.7	0	0.00	0.00	0.00	2	53.8	1
628	05	8.5	1	0	8.7	0	0.00	0.00	0.00	2	40.2	1
629	05	8.5	1	0	8.7	0	0.00	0.00	0.00	2	55.0	1
630	05	8.5	1	0	8.7	0	0.00	0.00	0.00	2	38.4	1
631	05	8.5	1	0	8.7	1	0.00	0.00	0.00	2	33.9	2
632	05	8.5	1	0	8.7	1	0.00	0.00	0.00	2	24.3	2
633	05	8.5	1	0	8.7	1	0.00	0.00	0.00	2	23.7	2
634	05	8.5	1	0	8.7	1	0.00	0.00	0.00	2	31.0	2
635	05	8.5	1	0	8.7	1	0.00	0.00	0.00	2	7.9	3
636	05	8.5	1	0	8.7	1	0.00	0.00	0.00	2	7.1	3
638	05	8.5	1	0	8.7	2	0.00	0.00	0.00	2	6.5	3
669	05	8.0	1	0	8.7	0	0.00	0.00	0.00	2	40.8	1
670	05	8.0	1	0	8.7	0	0.00	0.00	0.00	2	50.9	1
671	05	8.0	1	0	8.7	0	0.00	0.00	0.00	2	49.0	1
672	05	8.0	1	0	8.7	0	0.00	0.00	0.00	2	49.6	1
673	05	8.0	1	0	8.7	1	0.00	0.00	0.00	2	22.3	2
674	05	8.0	1	0	8.7	1	0.00	0.00	0.00	2	25.0	2
675	05	8.0	1	0	8.7	1	0.00	0.00	0.00	2	26.8	2
676	05	8.0	1	0	8.7	1	0.00	0.00	0.00	2	25.9	2
677	05	8.0	1	0	8.7	2	0.00	0.00	0.00	2	10.4	3
678	05	8.0	1	0	8.7	2	0.00	0.00	0.00	2	8.8	3
679	05	8.0	1	0	8.7	2	0.00	0.00	0.00	2	8.5	3
680	05	8.0	1	0	8.7	2	0.00	0.00	0.00	2	8.5	3
684	05	8.0	1	0	8.7	0	0.00	0.00	0.00	2	37.5	1
685	05	8.0	1	0	8.7	0	0.00	0.00	0.00	2	31.7	1
686	05	8.0	1	0	8.7	0	0.00	0.00	0.00	2	39.7	1
687	05	8.0	1	0	8.7	0	0.00	0.00	0.00	2	33.7	1
688	05	8.0	1	0	8.7	1	0.00	0.00	0.00	2	20.0	3
689	05	8.0	1	0	8.7	1	0.00	0.00	0.00	2	22.1	3
690	05	8.0	1	0	8.7	1	0.00	0.00	0.00	2	18.9	3
691	05	8.0	1	0	8.7	1	0.00	0.00	0.00	2	24.5	3
692	05	8.0	1	0	8.7	2	0.00	0.00	0.00	2	6.1	3
693	05	8.0	1	0	8.7	2	0.00	0.00	0.00	2	6.3	3
694	05	8.0	1	0	8.7	2	0.00	0.00	0.00	2	5.3	3
695	05	8.0	1	0	8.7	2	0.00	0.00	0.00	2	9.3	3
627	05	8.5	1	0	8.7	0	0.00	0.00	0.00	3	210000.0	1
629	05	8.5	1	0	8.7	0	0.00	0.00	0.00	3	450000.0	1
630	05	8.5	1	0	8.7	0	0.00	0.00	0.00	3	420000.0	1
631	05	8.5	1	0	8.7	1	0.00	0.00	0.00	3	32000.0	2
632	05	8.5	1	0	8.7	1	0.00	0.00	0.00	3	22000.0	2
633	05	8.5	1	0	8.7	1	0.00	0.00	0.00	3	18000.0	2
634	05	8.5	1	0	8.7	1	0.00	0.00	0.00	3	27500.0	2
635	05	8.5	1	0	8.7	1	0.00	0.00	0.00	3	6000.0	3
636	05	8.5	1	0	8.7	1	0.00	0.00	0.00	3	8000.0	3
638	05	8.5	1	0	8.7	1	0.00	0.00	0.00	3	3700.0	3
669	05	8.0	1	0	8.7	0	0.00	0.00	0.00	3	105000.0	1
670	05	8.0	1	0	8.7	0	0.00	0.00	0.00	3	140000.0	1
671	05	8.0	1	0	8.7	0	0.00	0.00	0.00	3	212000.0	1
672	05	8.0	1	0	8.7	0	0.00	0.00	0.00	3	170000.0	1
673	05	8.0	1	0	8.7	1	0.00	0.00	0.00	3	29000.0	2
674	05	8.0	1	0	8.7	1	0.00	0.00	0.00	3	25000.0	2
675	05	8.0	1	0	8.7	1	0.00	0.00	0.00	3	51000.0	2
676	05	8.0	1	0	8.7	1	0.00	0.00	0.00	3	50000.0	2
677	05	8.0	1	0	8.7	2	0.00	0.00	0.00	3	8400.0	3

'E' MODULUS RESEARCH DATA CORRELATION

SAMPLE NO.	SOURCE CODE	ASPHALT CONTENT %	SRC	FIL	200M	TRT	PERMEABLE VOIDS	MARSHALL VOIDS	DENSITY	CMP	STRESS LEVEL	STR
653	05	8.5	1	1	8.7	1	0.00	0.00	0.00	2	33.4	2
654	05	8.5	1	1	8.7	1	0.00	0.00	0.00	2	44.6	2
655	05	8.5	1	1	8.7	1	0.00	0.00	0.00	2	47.9	2
656	05	8.5	1	1	8.7	2	0.00	0.00	0.00	2	18.0	3
657	05	8.5	1	1	8.7	2	0.00	0.00	0.00	2	18.1	3
658	05	8.5	1	1	8.7	2	0.00	0.00	0.00	2	15.0	3
659	05	8.5	1	1	8.7	2	0.00	0.00	0.00	2	14.9	3
648	05	8.5	1	1	8.7	0	0.00	0.00	0.00	3	130000.0	1
649	05	8.5	1	1	8.7	0	0.00	0.00	0.00	3	220000.0	1
650	05	8.5	1	1	8.7	0	0.00	0.00	0.00	3	670000.0	1
651	05	8.5	1	1	8.7	0	0.00	0.00	0.00	3	600000.0	1
652	05	8.5	1	1	8.7	1	0.00	0.00	0.00	3	50000.0	2
653	05	8.5	1	1	8.7	1	0.00	0.00	0.00	3	46000.0	2
654	05	8.5	1	1	8.7	1	0.00	0.00	0.00	3	149000.0	2
655	05	8.5	1	1	8.7	1	0.00	0.00	0.00	3	71000.0	2
656	05	8.5	1	1	8.7	2	0.00	0.00	0.00	3	17000.0	3
657	05	8.5	1	1	8.7	2	0.00	0.00	0.00	3	19500.0	3
658	05	8.5	1	1	8.7	2	0.00	0.00	0.00	3	24000.0	3
659	05	8.5	1	1	8.7	2	0.00	0.00	0.00	3	17000.0	3
648	05	8.5	1	1	8.7	0	0.00	0.00	0.00	4	1093000.0	1
649	05	8.5	1	1	8.7	0	0.00	0.00	0.00	4	1247000.0	1
650	05	8.5	1	1	8.7	0	0.00	0.00	0.00	4	1079000.0	1
651	05	8.5	1	1	8.7	0	0.00	0.00	0.00	4	1366000.0	1
652	05	8.5	1	1	8.7	1	0.00	0.00	0.00	4	621000.0	2
653	05	8.5	1	1	8.7	1	0.00	0.00	0.00	4	552000.0	2
654	05	8.5	1	1	8.7	1	0.00	0.00	0.00	4	883000.0	2
655	05	8.5	1	1	8.7	1	0.00	0.00	0.00	4	773000.0	2
656	05	8.5	1	1	8.7	2	0.00	0.00	0.00	4	265000.0	3
657	05	8.5	1	1	8.7	2	0.00	0.00	0.00	4	336000.0	3
658	05	8.5	1	1	8.7	2	0.00	0.00	0.00	4	276000.0	3
659	05	8.5	1	1	8.7	2	0.00	0.00	0.00	4	280000.0	3

'E' MODULUS RESEARCH DATA CORRELATION

SAMPLE NO.	SOURCE CODE	ASPHALT CONTENT %	SRC	FIL	200M	TRT	PERMEABLE VOIDS	MARSHALL VOIDS	DENSITY	CMP	STRESS LEVEL	STR
678	05	8.0	1	0	8.7	2	0.00	0.00	0.00	3	5600.0	3
679	05	8.0	1	0	8.7	2	0.00	0.00	0.00	3	5400.0	3
680	05	8.0	1	0	8.7	2	0.00	0.00	0.00	3	4400.0	3
684	05	8.0	1	0	8.7	0	0.00	0.00	0.00	3	160000.0	1
685	05	8.0	1	0	8.7	0	0.00	0.00	0.00	3	140000.0	1
686	05	8.0	1	0	8.7	0	0.00	0.00	0.00	3	115000.0	1
687	05	8.0	1	0	8.7	0	0.00	0.00	0.00	3	125000.0	1
688	05	8.0	1	0	8.7	1	0.00	0.00	0.00	3	74000.0	3
689	05	8.0	1	0	8.7	1	0.00	0.00	0.00	3	22000.0	3
690	05	8.0	1	0	8.7	1	0.00	0.00	0.00	3	17500.0	3
691	05	8.0	1	0	8.7	1	0.00	0.00	0.00	3	22000.0	3
692	05	8.0	1	0	8.7	2	0.00	0.00	0.00	3	3000.0	3
693	05	8.0	1	0	8.7	2	0.00	0.00	0.00	3	13200.0	3
694	05	8.0	1	0	8.7	2	0.00	0.00	0.00	3	3300.0	3
695	05	8.0	1	0	8.7	2	0.00	0.00	0.00	3	4500.0	3
627	05	8.5	1	0	8.7	0	0.00	0.00	0.00	4	1564000.0	1
628	05	8.5	1	0	8.7	0	0.00	0.00	0.00	4	481000.0	1
629	05	8.5	1	0	8.7	0	0.00	0.00	0.00	4	1251000.0	1
630	05	8.5	1	0	8.7	0	0.00	0.00	0.00	4	777000.0	1
631	05	8.5	1	0	8.7	1	0.00	0.00	0.00	4	391000.0	2
632	05	8.5	1	0	8.7	1	0.00	0.00	0.00	4	287000.0	2
633	05	8.5	1	0	8.7	1	0.00	0.00	0.00	4	246000.0	2
634	05	8.5	1	0	8.7	1	0.00	0.00	0.00	4	324000.0	2
636	05	8.5	1	0	8.7	1	0.00	0.00	0.00	4	102000.0	3
638	05	8.5	1	0	8.7	1	0.00	0.00	0.00	4	80000.0	3
669	05	8.0	1	0	8.7	0	0.00	0.00	0.00	4	780000.0	1
670	05	8.0	1	0	8.7	0	0.00	0.00	0.00	4	798000.0	1
671	05	8.0	1	0	8.7	0	0.00	0.00	0.00	4	1308000.0	1
672	05	8.0	1	0	8.7	0	0.00	0.00	0.00	4	650000.0	1
673	05	8.0	1	0	8.7	1	0.00	0.00	0.00	4	177000.0	2
674	05	8.0	1	0	8.7	1	0.00	0.00	0.00	4	303000.0	2
675	05	8.0	1	0	8.7	1	0.00	0.00	0.00	4	259000.0	2
676	05	8.0	1	0	8.7	1	0.00	0.00	0.00	4	341000.0	2
677	05	8.0	1	0	8.7	2	0.00	0.00	0.00	4	111000.0	3
678	05	8.0	1	0	8.7	2	0.00	0.00	0.00	4	104000.0	3
679	05	8.0	1	0	8.7	2	0.00	0.00	0.00	4	75000.0	3
680	05	8.0	1	0	8.7	2	0.00	0.00	0.00	4	107000.0	3
684	05	8.0	1	0	8.7	0	0.00	0.00	0.00	4	979000.0	1
685	05	8.0	1	0	8.7	0	0.00	0.00	0.00	4	766000.0	1
686	05	8.0	1	0	8.7	0	0.00	0.00	0.00	4	619000.0	1
687	05	8.0	1	0	8.7	0	0.00	0.00	0.00	4	978000.0	1
688	05	8.0	1	0	8.7	1	0.00	0.00	0.00	4	247000.0	3
689	05	8.0	1	0	8.7	1	0.00	0.00	0.00	4	214000.0	3
690	05	8.0	1	0	8.7	1	0.00	0.00	0.00	4	262000.0	3
691	05	8.0	1	0	8.7	1	0.00	0.00	0.00	4	315000.0	3
692	05	8.0	1	0	8.7	2	0.00	0.00	0.00	4	48000.0	3
693	05	8.0	1	0	8.7	2	0.00	0.00	0.00	4	75000.0	3
694	05	8.0	1	0	8.7	2	0.00	0.00	0.00	4	51000.0	3
695	05	8.0	1	0	8.7	2	0.00	0.00	0.00	4	89000.0	3
648	05	8.5	1	1	8.7	0	0.00	0.00	0.00	2	53.0	1
649	05	8.5	1	1	8.7	0	0.00	0.00	0.00	2	62.1	1
650	05	8.5	1	1	8.7	0	0.00	0.00	0.00	2	46.3	1
651	05	8.5	1	1	8.7	0	0.00	0.00	0.00	2	59.4	1
652	05	8.5	1	1	8.7	1	0.00	0.00	0.00	2	34.0	2

'E' MODULUS RESEARCH DATA CORRELATION

SAMPLE NO.	SOURCE CODE	ASPHALT CONTENT %	SRC	FIL	200M	TRT	PERMEABLE VOIDS	MARSHALL VOIDS	DENSITY	CMP	STRESS LEVEL	ST
004	01	5.0	1	0	4.2	0	0.00	7.66	2.29	5	1050.0	0
005	01	5.0	1	0	4.2	0	0.00	8.19	2.28	5	915.0	0
010	01	5.5	1	0	4.2	0	0.00	6.54	2.30	5	1066.0	0
011	01	5.5	1	0	4.2	0	0.00	5.65	2.32	5	1411.0	0
016	01	6.0	1	0	4.2	0	0.00	5.31	2.32	5	1312.0	0
017	01	6.0	1	0	4.2	0	0.00	5.23	2.32	5	1040.0	0
022	01	6.5	1	0	4.2	0	0.00	5.31	2.32	5	1175.0	0
023	01	6.5	1	0	4.2	0	0.00	5.23	2.32	5	773.0	0
028	01	6.0	1	0	3.0	0	0.00	4.86	2.31	5	880.0	0
029	01	6.0	1	0	3.0	0	0.00	4.94	2.31	5	915.0	0
034	01	6.5	1	0	4.2	0	0.00	4.73	2.31	5	1092.0	0
035	01	6.5	1	0	4.2	0	0.00	4.28	2.33	5	1326.0	0
040	01	6.5	1	0	5.0	0	0.00	3.54	2.34	5	1326.0	0
041	01	6.5	1	0	5.0	0	0.00	3.50	2.34	5	1254.0	0
046	01	6.5	1	0	5.6	0	0.00	3.62	0.00	5	1411.0	0
047	01	6.5	1	0	5.6	0	0.00	4.24	0.00	5	1222.0	0
052	01	6.0	1	0	3.0	0	0.00	4.98	2.31	5	893.0	0
058	01	6.5	1	0	4.2	0	0.00	4.49	2.32	5	1092.0	0
064	01	6.5	1	0	5.0	0	0.00	3.46	2.34	5	1326.0	0
070	01	6.5	1	0	5.6	0	0.00	3.87	0.00	5	1217.0	0
076	01	5.0	1	0	4.2	0	0.00	8.15	2.28	5	915.0	0
082	01	5.5	1	0	4.2	0	0.00	6.70	2.30	5	998.0	0
088	01	6.0	1	0	4.2	0	0.00	4.95	2.32	5	1242.0	0
094	01	6.5	1	0	4.2	0	0.00	4.95	2.33	5	1326.0	0
004	01	5.0	1	0	4.2	0	0.00	7.66	2.29	6	10.0	0
005	01	5.0	1	0	4.2	0	0.00	8.19	2.28	6	8.0	0
010	01	5.5	1	0	4.2	0	0.00	6.54	2.30	6	8.0	0
011	01	5.5	1	0	4.2	0	0.00	5.65	2.32	6	7.0	0
016	01	6.0	1	0	4.2	0	0.00	5.31	2.32	6	12.0	0
017	01	6.0	1	0	4.2	0	0.00	5.23	2.32	6	11.0	0
022	01	6.5	1	0	4.2	0	0.00	5.31	2.32	6	10.0	0
023	01	6.5	1	0	4.2	0	0.00	5.23	2.32	6	12.0	0
028	01	6.0	1	0	3.0	0	0.00	4.86	2.31	6	8.0	0
029	01	6.0	1	0	3.0	0	0.00	4.94	2.31	6	11.0	0
034	01	6.5	1	0	4.2	0	0.00	4.73	2.31	6	9.0	0
035	01	6.5	1	0	4.2	0	0.00	4.28	2.33	6	7.0	0
040	01	6.5	1	0	5.0	0	0.00	3.54	2.34	6	7.0	0
041	01	6.5	1	0	5.0	0	0.00	3.50	2.34	6	7.0	0
046	01	6.5	1	0	5.6	0	0.00	3.62	0.00	6	8.0	0
047	01	6.5	1	0	5.6	0	0.00	4.24	0.00	6	8.0	0
052	01	6.0	1	0	3.0	0	0.00	4.98	2.31	6	7.0	0
058	01	6.5	1	0	4.2	0	0.00	4.49	2.32	6	11.0	0
064	01	6.5	1	0	5.0	0	0.00	3.46	2.34	6	11.0	0
070	01	6.5	1	0	5.6	0	0.00	3.87	0.00	6	10.0	0
076	01	5.0	1	0	4.2	0	0.00	8.15	2.28	6	10.0	0
082	01	5.5	1	0	4.2	0	0.00	6.70	2.30	6	9.0	0
088	01	6.0	1	0	4.2	0	0.00	4.95	2.32	6	7.0	0
094	01	6.5	1	0	4.2	0	0.00	4.95	2.33	6	7.0	0

'E' MODULUS RESEARCH DATA CORRELATION

SAMPLE NO.	SOURCE CODE	ASPHALT CONTENT %	SRC	FIL	200M	TRT	PERMEABLE VOIDS	MARSHALL VOIDS	DENSITY	CMP	STRESS LEVEL	STR
177	02	6.5	2	0	17.3	0	0.00	3.52	2.33	5	2133.0	0
178	02	6.5	2	0	17.3	0	0.00	3.76	2.33	5	2217.0	0
179	02	6.5	2	0	17.3	0	0.00	3.97	2.32	5	2062.0	0
180	02	6.5	2	0	17.3	0	0.00	3.85	2.32	5	2035.0	0
201	02	6.5	2	0	8.6	0	0.00	7.11	2.25	5	1262.0	0
202	02	6.5	2	0	8.6	0	0.00	6.91	2.25	5	1064.0	0
203	02	6.5	2	0	8.6	0	0.00	6.74	2.26	5	1261.0	0
204	02	6.5	2	0	8.6	0	0.00	6.78	2.25	5	1106.0	0
225	02	6.5	2	0	8.6	0	0.00	4.84	2.30	5	714.0	0
226	02	6.5	2	0	8.6	0	0.00	4.47	2.31	5	753.0	0
227	02	6.5	2	0	8.6	0	0.00	5.21	2.29	5	809.0	0
228	02	6.5	2	0	8.6	0	0.00	5.17	2.29	5	752.0	0
268	02	6.5	2	2	8.6	0	0.00	5.67	0.00	5	1476.0	0
269	02	6.5	2	2	8.6	0	0.00	4.92	0.00	5	1600.0	0
270	02	6.5	2	2	8.6	0	0.00	5.54	0.00	5	1314.0	0
289	02	6.5	2	3	8.6	0	0.00	5.50	2.29	5	1400.0	0
290	02	6.5	2	3	8.6	0	0.00	5.33	2.29	5	1381.0	0
291	02	6.5	2	3	8.6	0	0.00	6.24	2.27	5	1343.0	0
310	02	6.8	2	0	17.3	0	0.00	3.49	2.32	5	1906.0	0
311	02	6.8	2	0	17.3	0	0.00	3.08	2.33	5	2115.0	0
312	02	6.8	2	0	17.3	0	0.00	3.62	2.32	5	1470.0	0
337	02	6.5	2	0	17.3	0	0.00	6.83	2.25	5	1049.0	0
338	02	6.5	2	0	17.3	0	0.00	6.83	2.25	5	857.0	0
339	02	6.5	2	0	17.3	0	0.00	6.71	2.25	5	1008.0	0
340	02	6.5	2	0	17.3	0	0.00	5.80	2.28	5	1175.0	0
341	02	6.5	2	0	17.3	0	0.00	5.63	2.28	5	1152.0	0
342	02	6.5	2	0	17.3	0	0.00	6.38	2.26	5	1162.0	0
343	02	6.5	2	0	17.3	0	0.00	4.43	2.31	5	1386.0	0
344	02	6.5	2	0	17.3	0	0.00	5.18	2.29	5	1386.0	0
351	02	6.5	2	0	8.6	0	0.00	3.56	2.33	5	1185.0	1
352	02	6.5	2	0	8.6	0	0.00	3.64	2.33	5	1150.0	1
353	02	6.5	2	0	8.6	0	0.00	3.93	2.32	5	1185.0	1
372	02	8.0	2	1	8.6	0	0.00	3.79	2.28	5	1833.0	0
373	02	8.0	2	1	8.6	0	0.00	3.46	2.29	5	1750.0	0
374	02	8.0	2	1	8.6	0	0.00	4.26	2.27	5	1343.0	0
393	02	8.0	2	2	8.6	0	0.00	1.94	2.33	5	1392.0	0
394	02	8.0	2	2	8.6	0	0.00	1.90	2.33	5	1289.0	0
395	02	8.0	2	2	8.6	0	0.00	2.27	2.32	5	1330.0	0
414	02	8.0	2	3	8.6	0	0.00	4.46	2.34	5	1627.0	0
415	02	8.0	2	3	8.6	0	0.00	4.13	2.34	5	1850.0	0
416	02	8.0	2	3	8.6	0	0.00	4.05	2.35	5	1524.0	0
177	02	6.5	2	0	17.3	0	0.00	3.52	2.33	6	11.0	0
178	02	6.5	2	0	17.3	0	0.00	3.76	2.33	6	9.0	0
179	02	6.5	2	0	17.3	0	0.00	3.97	2.32	6	8.0	0
180	02	6.5	2	0	17.3	0	0.00	3.85	2.32	6	9.0	0
201	02	6.5	2	0	8.6	0	0.00	7.11	2.25	6	8.0	0
202	02	6.5	2	0	8.6	0	0.00	6.91	2.25	6	8.0	0
203	02	6.5	2	0	8.6	0	0.00	6.74	2.26	6	8.0	0
204	02	6.5	2	0	8.6	0	0.00	6.78	2.25	6	9.0	0
225	02	6.5	2	0	8.6	0	0.00	4.84	2.30	6	8.0	0
226	02	6.5	2	0	8.6	0	0.00	4.47	2.31	6	9.0	0
227	02	6.5	2	0	8.6	0	0.00	5.21	2.29	6	8.0	0
228	02	6.5	2	0	8.6	0	0.00	5.17	2.29	6	6.0	0
268	02	6.5	2	2	8.6	0	0.00	5.67	0.00	6	8.0	0

'E' MODULUS RESEARCH DATA CORRELATION

SAMPLE NO.	SOURCE CODE	ASPHALT CONTENT %	SRC	FIL	200M	TRT	PERMEABLE VOIDS	MARSHALL VOIDS	DENSITY	CMP	STRESS LEVEL	STR
269	02	6.5	2	2	8.6	0	0.00	4.92	0.00	6	6.0	0
270	02	6.5	2	2	8.6	0	0.00	5.54	0.00	6	7.0	0
289	02	6.5	2	3	8.6	0	0.00	5.50	2.29	6	8.0	0
290	02	6.5	2	3	8.6	0	0.00	5.33	2.29	6	8.0	0
291	02	6.5	2	3	8.6	0	0.00	6.24	2.27	6	8.0	0
310	02	6.8	2	0	17.3	0	0.00	3.49	2.32	6	15.0	0
311	02	6.8	2	0	17.3	0	0.00	3.08	2.33	6	13.0	0
312	02	6.8	2	0	17.3	0	0.00	3.62	2.32	6	21.0	0
337	02	6.5	2	0	17.3	0	0.00	6.83	2.25	6	10.0	0
338	02	6.5	2	0	17.3	0	0.00	6.83	2.25	6	9.0	0
339	02	6.5	2	0	17.3	0	0.00	6.71	2.25	6	12.0	0
340	02	6.5	2	0	17.3	0	0.00	5.80	2.28	6	13.0	0
341	02	6.5	2	0	17.3	0	0.00	5.63	2.28	6	10.0	0
342	02	6.5	2	0	17.3	0	0.00	6.38	2.26	6	8.0	0
343	02	6.5	2	0	17.3	0	0.00	4.43	2.31	6	9.0	0
344	02	6.5	2	0	17.3	0	0.00	5.18	2.29	6	8.0	0
351	02	6.5	2	0	8.6	0	0.00	3.56	2.33	6	15.0	1
352	02	6.5	2	0	8.6	0	0.00	3.64	2.33	6	13.0	1
353	02	6.5	2	0	8.6	0	0.00	3.93	2.32	6	13.0	1
372	02	8.0	2	1	8.6	0	0.00	3.79	2.28	6	16.0	0
373	02	8.0	2	1	8.6	0	0.00	3.46	2.29	6	16.0	0
374	02	8.0	2	1	8.6	0	0.00	4.26	2.27	6	16.0	0
393	02	8.0	2	2	8.6	0	0.00	1.94	2.33	6	10.0	0
394	02	8.0	2	2	8.6	0	0.00	1.90	2.33	6	9.0	0
395	02	8.0	2	2	8.6	0	0.00	2.27	2.32	6	9.0	0
414	02	8.0	2	3	8.6	0	0.00	4.43	2.34	6	10.0	0
415	02	8.0	2	3	8.6	0	0.00	4.13	2.34	6	10.0	0
416	02	8.0	2	3	8.6	0	0.00	4.05	2.35	6	11.0	0

'E' MODULUS RESEARCH DATA CORRELATION

SAMPLE NO.	SOURCE CODE	ASPHALT CONTENT %	SRC	FIL	200M	TRT	PERMEABLE VOIDS	MARSHALL VOIDS	DENSITY	CMP	STRESS LEVEL	STR
435	03	6.5	2	0	6.9	0	0.00	2.29	2.35	5	1375.0	0
436	03	6.5	2	0	6.9	0	0.00	2.37	2.34	5	1508.0	0
437	03	6.5	2	0	6.9	0	0.00	2.42	2.34	5	1338.0	0
456	03	6.5	2	1	6.9	0	0.00	2.00	2.35	5	1025.0	0
457	03	6.5	2	1	6.9	0	0.00	2.12	2.35	5	1092.0	0
458	03	6.5	2	1	6.9	0	0.00	1.92	2.36	5	940.0	0
477	03	6.5	2	2	6.9	0	0.00	2.21	2.35	5	1030.0	0
478	03	6.5	2	2	6.9	0	0.00	2.21	2.35	5	1040.0	0
479	03	6.5	2	2	6.9	0	0.00	2.16	2.35	5	1092.0	0
498	03	6.5	2	3	6.9	0	0.00	2.08	2.36	5	929.0	0
499	03	6.5	2	3	6.9	0	0.00	2.00	2.36	5	1000.0	0
500	03	6.5	2	3	6.9	0	0.00	1.87	2.36	5	1117.0	0
435	03	6.5	2	0	6.9	0	0.00	2.29	2.35	6	3.0	0
436	03	6.5	2	0	6.9	0	0.00	2.37	2.34	6	5.0	0
437	03	6.5	2	0	6.9	0	0.00	2.42	2.34	6	4.0	0
456	03	6.5	2	1	6.9	0	0.00	2.00	2.35	6	15.0	0
457	03	6.5	2	1	6.9	0	0.00	2.12	2.35	6	15.0	0
458	03	6.5	2	1	6.9	0	0.00	1.92	2.36	6	15.0	0
477	03	6.5	2	2	6.9	0	0.00	2.21	2.35	6	13.0	0
478	03	6.5	2	2	6.9	0	0.00	2.21	2.35	6	14.0	0
479	03	6.5	2	2	6.9	0	0.00	2.16	2.35	6	14.0	0
498	03	6.5	2	3	6.9	0	0.00	2.08	2.36	6	14.0	0
499	03	6.5	2	3	6.9	0	0.00	2.00	2.36	6	13.0	0
500	03	6.5	2	3	6.9	0	0.00	1.87	2.36	6	13.0	0

'E' MODULUS RESEARCH DATA CORRELATION

SAMPLE NO.	SOURCE CODE	ASPHALT CONTENT %	SRC	FIL	200M	TRT	PERMEABLE VOIDS	MARSHALL VOIDS	DENSITY	CMP	STRESS LEVEL	STR
519	04	6.2	2	0	4.6	0	0.00	3.78	2.34	5	1326.0	0
520	04	6.2	2	0	4.6	0	0.00	3.20	2.36	5	989.0	0
521	04	6.2	2	0	4.6	0	0.00	3.28	2.36	5	1308.0	0
534	04	5.7	2	0	4.6	0	0.00	5.26	2.32	5	1176.0	0
535	04	5.7	2	0	4.6	0	0.00	5.42	2.32	5	1025.0	0
536	04	5.7	2	0	4.6	0	0.00	5.26	2.32	5	1117.0	0
561	04	6.2	2	1	4.6	0	0.00	3.45	2.35	5	1196.0	0
562	04	6.2	2	1	4.6	0	0.00	3.57	2.35	5	1122.0	0
563	04	6.2	2	1	4.6	0	0.00	3.49	2.35	5	1030.0	0
582	04	6.2	2	2	4.6	0	0.00	3.61	2.35	5	804.0	0
583	04	6.2	2	2	4.6	0	0.00	3.86	2.34	5	804.0	0
584	04	6.2	2	2	4.6	0	0.00	3.94	2.34	5	907.0	0
603	04	6.2	2	3	4.6	0	0.00	4.46	2.33	5	998.0	0
604	04	6.2	2	3	4.6	0	0.00	3.27	2.36	5	1222.0	0
605	04	6.2	2	3	4.6	0	0.00	3.85	2.35	5	1248.0	0
702	04	6.2	2	0	4.6	0	0.00	5.38	2.31	5	1040.0	0
703	04	6.2	2	0	4.6	0	0.00	5.29	2.31	5	673.0	0
704	04	6.2	2	0	4.6	0	0.00	5.38	2.31	5	673.0	0
723	04	5.9	2	0	4.6	0	0.00	4.78	2.33	5	1117.0	0
724	04	5.9	2	0	4.6	0	0.00	4.99	2.32	5	1117.0	0
725	04	5.9	2	0	4.6	0	0.00	4.95	2.32	5	1090.0	0
738	04	6.2	1	0	4.6	0	0.00	4.68	2.32	5	1079.0	0
739	04	6.2	1	0	4.6	0	0.00	4.27	2.33	5	1025.0	0
740	04	6.2	1	0	4.6	0	0.00	4.55	2.33	5	1117.0	0
753	04	6.2	2	0	4.6	0	0.00	4.02	2.34	5	2010.0	0
754	04	6.2	2	0	4.6	0	0.00	4.72	2.32	5	1662.0	0
755	04	6.2	2	0	4.6	0	0.00	4.23	2.33	5	1520.0	0
768	04	6.2	1	0	4.6	0	0.00	5.29	2.31	5	1308.0	0
769	04	6.2	1	0	4.6	0	0.00	3.73	2.35	5	1376.0	0
770	04	6.2	1	0	4.6	0	0.00	3.82	2.34	5	1494.0	0
783	04	5.5	1	0	4.6	0	0.00	5.69	2.32	5	894.0	0
784	04	5.5	1	0	4.6	0	0.00	5.73	2.32	5	929.0	0
785	04	5.5	1	0	4.6	0	0.00	6.06	2.31	5	978.0	0
519	04	6.2	2	0	4.6	0	0.00	3.78	2.34	6	9.0	0
520	04	6.2	2	0	4.6	0	0.00	3.20	2.36	6	11.0	0
521	04	6.2	2	0	4.6	0	0.00	3.28	2.36	6	11.0	0
534	04	5.7	2	0	4.6	0	0.00	5.26	2.32	6	10.0	0
535	04	5.7	2	0	4.6	0	0.00	5.42	2.32	6	9.0	0
536	04	5.7	2	0	4.6	0	0.00	5.26	2.32	6	8.0	0
561	04	6.2	2	1	4.6	0	0.00	3.45	2.35	6	10.0	0
562	04	6.2	2	1	4.6	0	0.00	3.57	2.35	6	11.0	0
563	04	6.2	2	1	4.6	0	0.00	3.49	2.35	6	11.0	0
582	04	6.2	2	2	4.6	0	0.00	3.61	2.35	6	9.0	0
583	04	6.2	2	2	4.6	0	0.00	3.86	2.34	6	10.0	0
584	04	6.2	2	2	4.6	0	0.00	3.94	2.34	6	9.0	0
603	04	6.2	2	3	4.6	0	0.00	4.46	2.33	6	7.0	0
604	04	6.2	2	3	4.6	0	0.00	3.27	2.36	6	9.0	0
605	04	6.2	2	3	4.6	0	0.00	3.85	2.35	6	7.0	0
702	04	6.2	2	0	4.6	0	0.00	5.38	2.31	6	10.0	0
703	04	6.2	2	0	4.6	0	0.00	5.29	2.31	6	6.0	0
704	04	6.2	2	0	4.6	0	0.00	5.38	2.31	6	4.0	0
723	04	5.9	2	0	4.6	0	0.00	4.78	2.33	6	5.0	0
724	04	5.9	2	0	4.6	0	0.00	4.99	2.32	6	5.0	0
725	04	5.9	2	0	4.6	0	0.00	4.95	2.32	6	6.0	0

'E' MODULUS RESEARCH DATA CORRELATION

SAMPLE NO.	SOURCE CODE	ASPHALT CONTENT %	SRC	FIL	200M	TRT	PERMEABLE VOIDS	MARSHALL VOIDS	DENSITY	CMP	STRESS LEVEL	STR
738	04	6.2	1	0	4.6	0	0.00	4.68	2.32	6	6.0	0
739	04	6.2	1	0	4.6	0	0.00	4.27	2.33	6	5.0	0
740	04	6.2	1	0	4.6	0	0.00	4.55	2.33	6	6.0	0
753	04	6.2	2	0	4.6	0	0.00	4.02	2.34	6	6.0	0
754	04	6.2	2	0	4.6	0	0.00	4.72	2.32	6	7.0	0
755	04	6.2	2	0	4.6	0	0.00	4.23	2.33	6	6.0	0
768	04	6.2	1	0	4.6	0	0.00	5.29	2.31	6	7.0	0
769	04	6.2	1	0	4.6	0	0.00	3.73	2.35	6	5.0	0
770	04	6.2	1	0	4.6	0	0.00	3.82	2.34	6	6.0	0
783	04	5.5	1	0	4.6	0	0.00	5.69	2.32	6	7.0	0
784	04	5.5	1	0	4.6	0	0.00	5.73	2.32	6	7.0	0
785	04	5.5	1	0	4.6	0	0.00	6.06	2.31	6	7.0	0

'E' MODULUS RESEARCH DATA CORRELATION

SAMPLE NO.	SOURCE CODE	ASPHALT CONTENT %	SRC	FIL	200M	TRT	PERMEABLE VOIDS	MARSHALL VOIDS	DENSITY	CMP	STRESS LEVEL	STR
624	05	8.5	1	0	8.7	0	0.00	0.00	1.90	5	1099.0	0
625	05	8.5	1	0	8.7	0	0.00	0.00	1.90	5	914.0	0
626	05	8.5	1	0	8.7	0	0.00	0.00	1.93	5	996.0	0
645	05	8.5	1	1	8.7	0	0.00	0.00	1.94	5	1365.0	0
646	05	8.5	1	1	8.7	0	0.00	0.00	1.92	5	1012.0	0
647	05	8.5	1	1	8.7	0	0.00	0.00	1.94	5	1245.0	0
666	05	8.0	1	0	8.7	0	0.00	0.00	1.91	5	1012.0	0
667	05	8.0	1	0	8.7	0	0.00	0.00	1.87	5	986.0	0
668	05	8.0	1	0	8.7	0	0.00	0.00	1.92	5	1058.0	0
681	05	8.0	1	0	8.7	0	0.00	0.00	0.00	5	740.0	0
682	05	8.0	1	0	8.7	0	0.00	0.00	0.00	5	568.0	0
683	05	8.0	1	0	8.7	0	0.00	0.00	0.00	5	705.0	0
624	05	8.5	1	0	8.7	0	0.00	0.00	1.90	6	10.0	0
625	05	8.5	1	0	8.7	0	0.00	0.00	1.90	6	12.0	0
626	05	8.5	1	0	8.7	0	0.00	0.00	1.93	6	16.0	0
645	05	8.5	1	1	8.7	0	0.00	0.00	1.94	6	15.0	0
646	05	8.5	1	1	8.7	0	0.00	0.00	1.92	6	18.0	0
647	05	8.5	1	1	8.7	0	0.00	0.00	1.94	6	10.0	0
666	05	8.0	1	0	8.7	0	0.00	0.00	1.91	6	14.0	0
667	05	8.0	1	0	8.7	0	0.00	0.00	1.87	6	14.0	0
668	05	8.0	1	0	8.7	0	0.00	0.00	1.92	6	16.0	0
681	05	8.0	1	0	8.7	0	0.00	0.00	0.00	6	21.0	0
682	05	8.0	1	0	8.7	0	0.00	0.00	0.00	6	18.0	0
683	05	8.0	1	0	8.7	0	0.00	0.00	0.00	6	19.0	0

Appendix B

When general relationships of the data information had been developed through the listing technique previously described, a need developed for compactly stored data for finding data graph point positions. A specimen inventory sheet describing the specimen, treatment, test ratios, stripping and other engineering variables was developed. These provided all of the information in a convenient form. Copies of this information are found in this portion of the Appendix.

AGGREGATE SOURCE Divide North

ASPHALT SOURCE Continental 6.5%

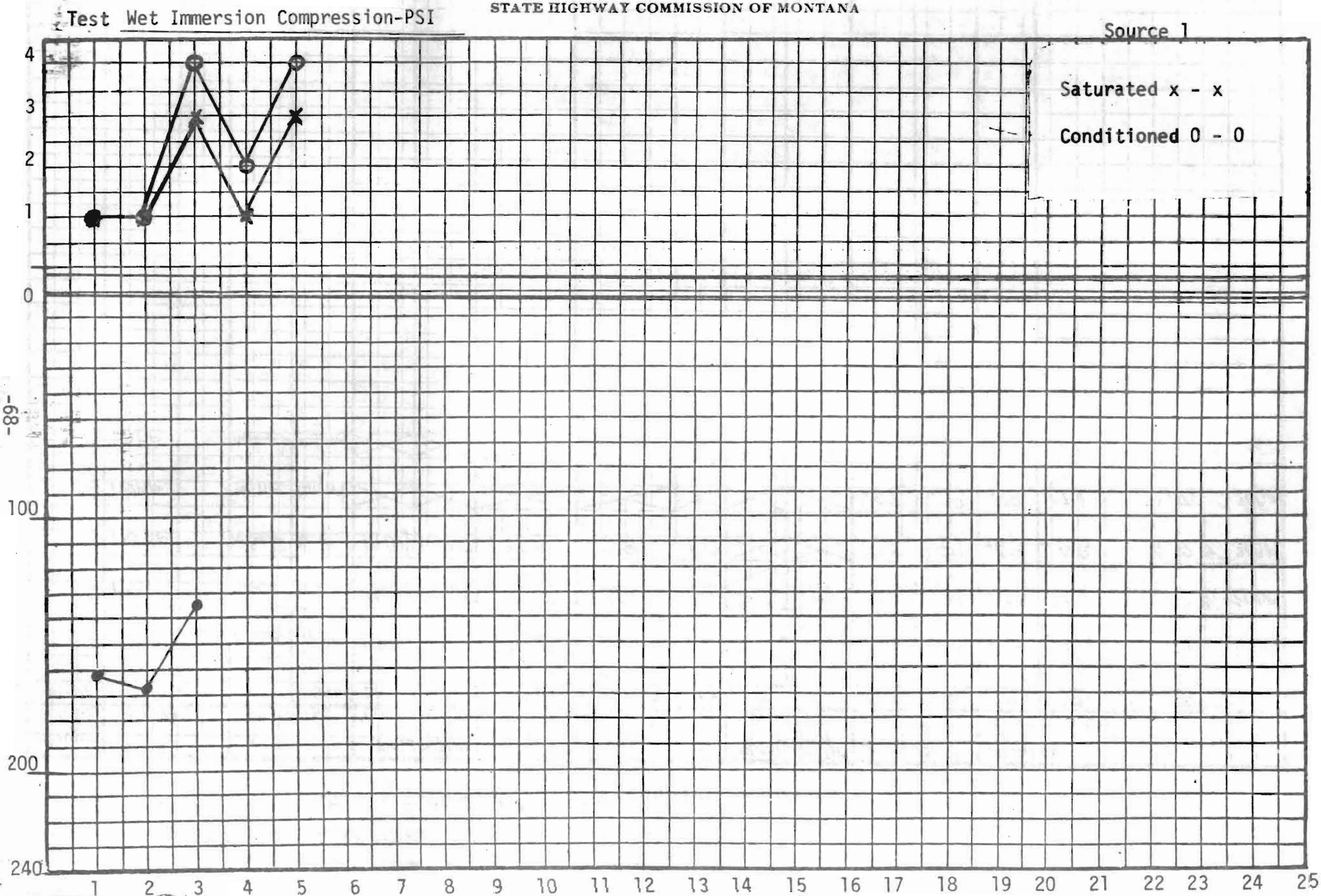
200M % varies - see remarks

STATE HIGHWAY COMMISSION OF MONTANA

Group SAMPLE NUMBER	FILLER TYPE	FILLER %	STRIPPING SAT	STRIPPING COND.	IMMERSION COMPRESSION DRY	IMMERSION COMPRESSION WET	IMMERSION COMPRESSION RATIO	MARSHALL STABILITY	MARSHALL FLOW	MODULUS OF RES RATIO SAT	MODULUS OF RES RATIO COND.	E MODULUS RATIO SAT	E MODULUS RATIO COND.	TENSILE STRESS RATIO SAT	TENSILE STRESS RATIO COND.	REMARKS
1	none		none	none	178	162.3	.912	1583	14			1.74	2.39	.93	.806	9.3% -200M
2	none		none	none	180.9	167.4	.925	1369	21			.84	1.79	.87	.91	17.8% -200M
3	none		moderate	Severe	140.1	133.7	.954	1388	10			.46	.49	.63	.48	4.2% -200M
4	none		none	Light								.07	.09	.78	.71	1.78% -200M
5	none		moderate	Severe						.54	.38	.54	.37	.75	.60	4.2% -200M

Divide - North

STATE HIGHWAY COMMISSION OF MONTANA



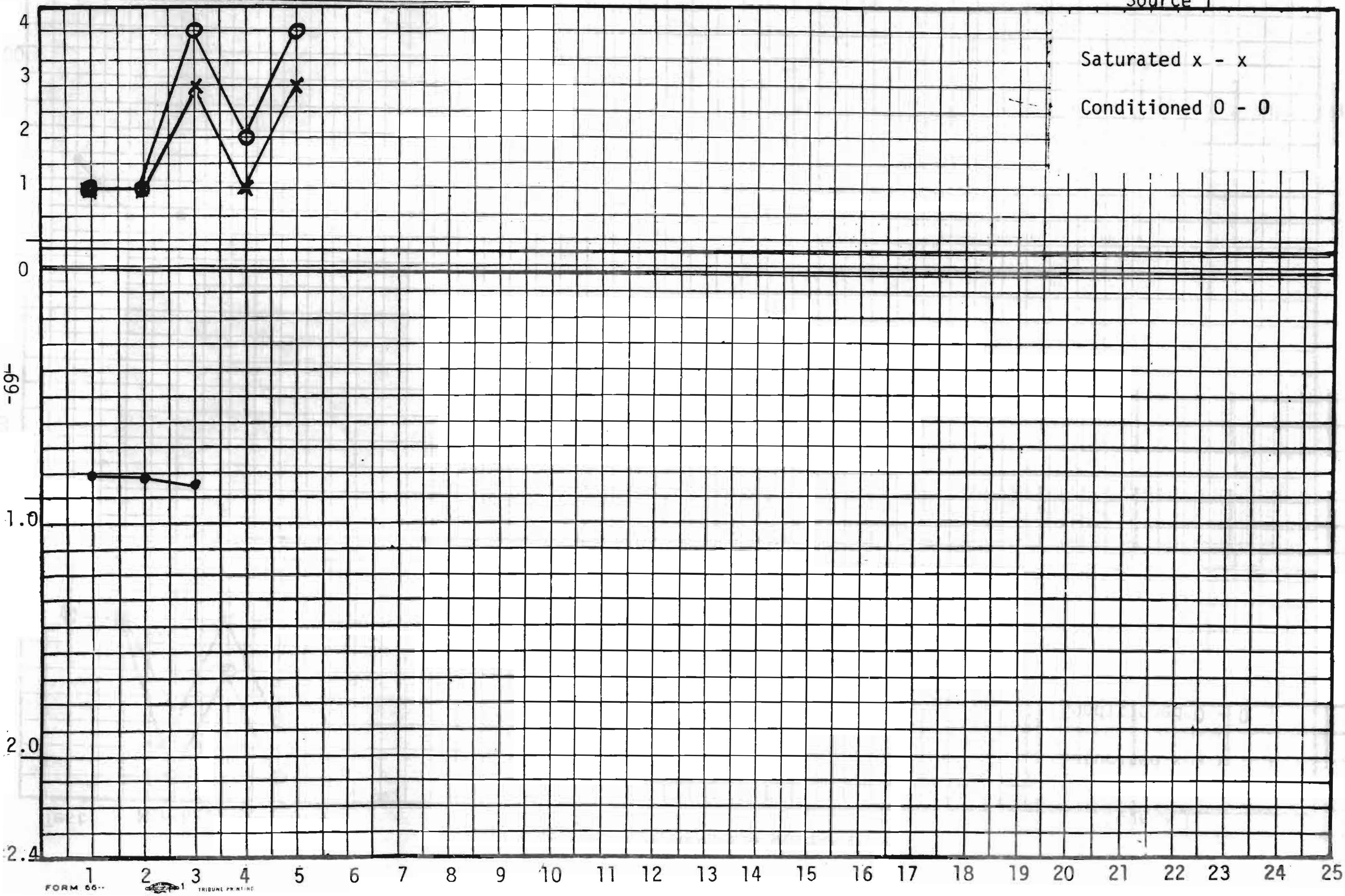
-89-

Divide - North

STATE HIGHWAY COMMISSION OF MONTANA

Test Immersion Compression Ratio

Source 1



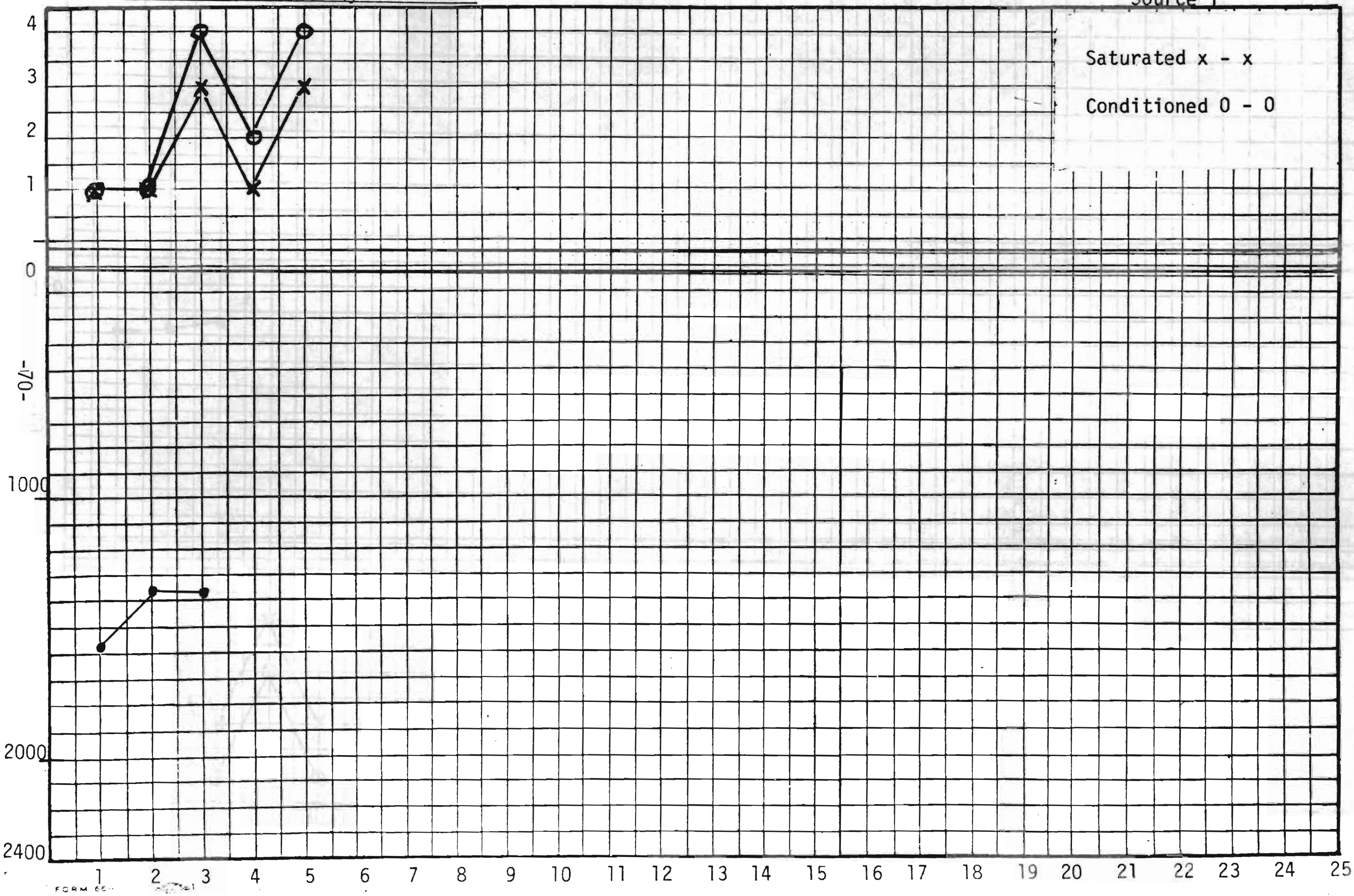
FORM 66 TRIBUNE PRINTING

Divide - North

STATE HIGHWAY COMMISSION OF MONTANA

Test Marshall Stability

Source 1

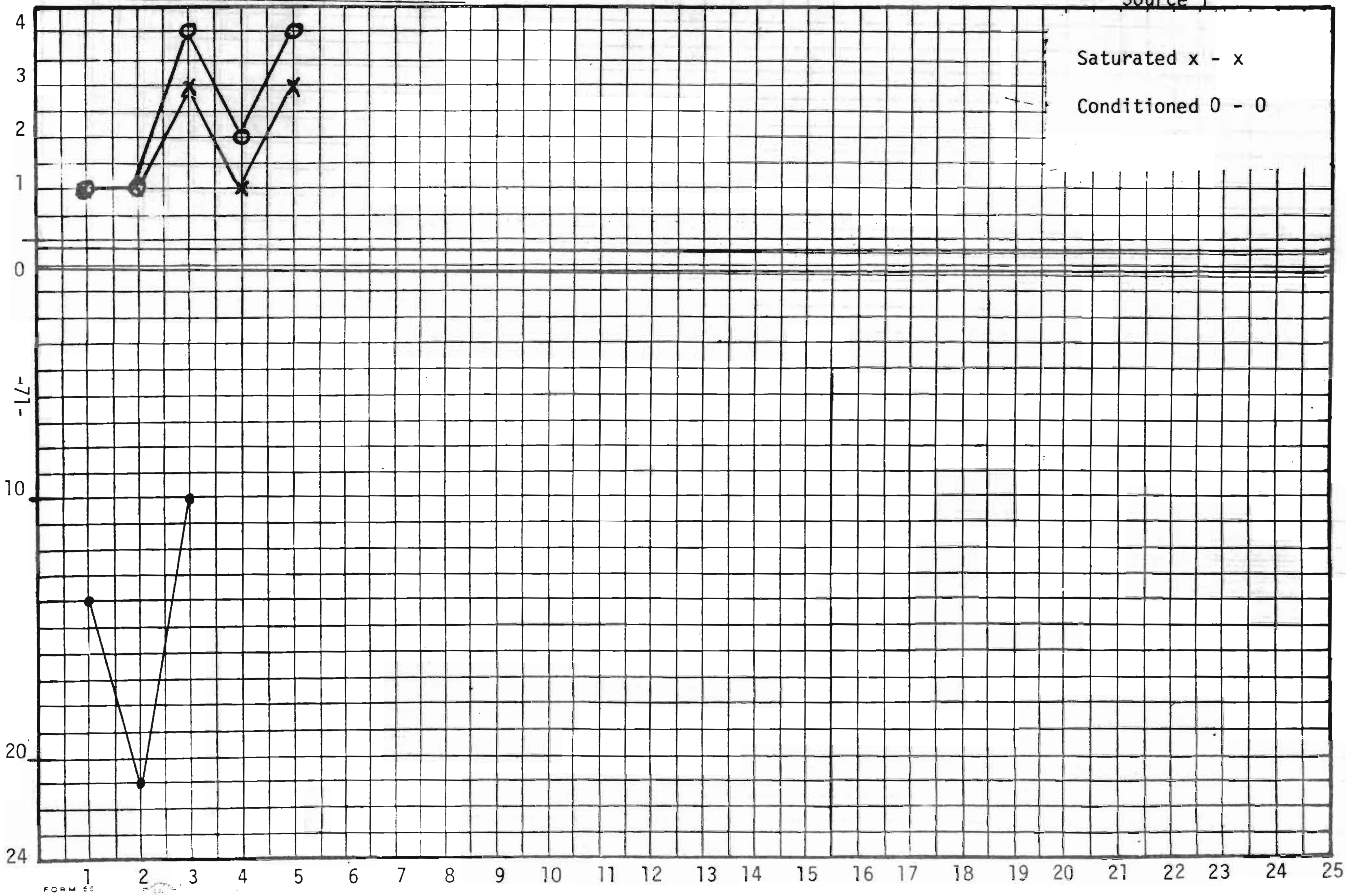


Divide - North

STATE HIGHWAY COMMISSION OF MONTANA

Test Marshall Flow

Source 1

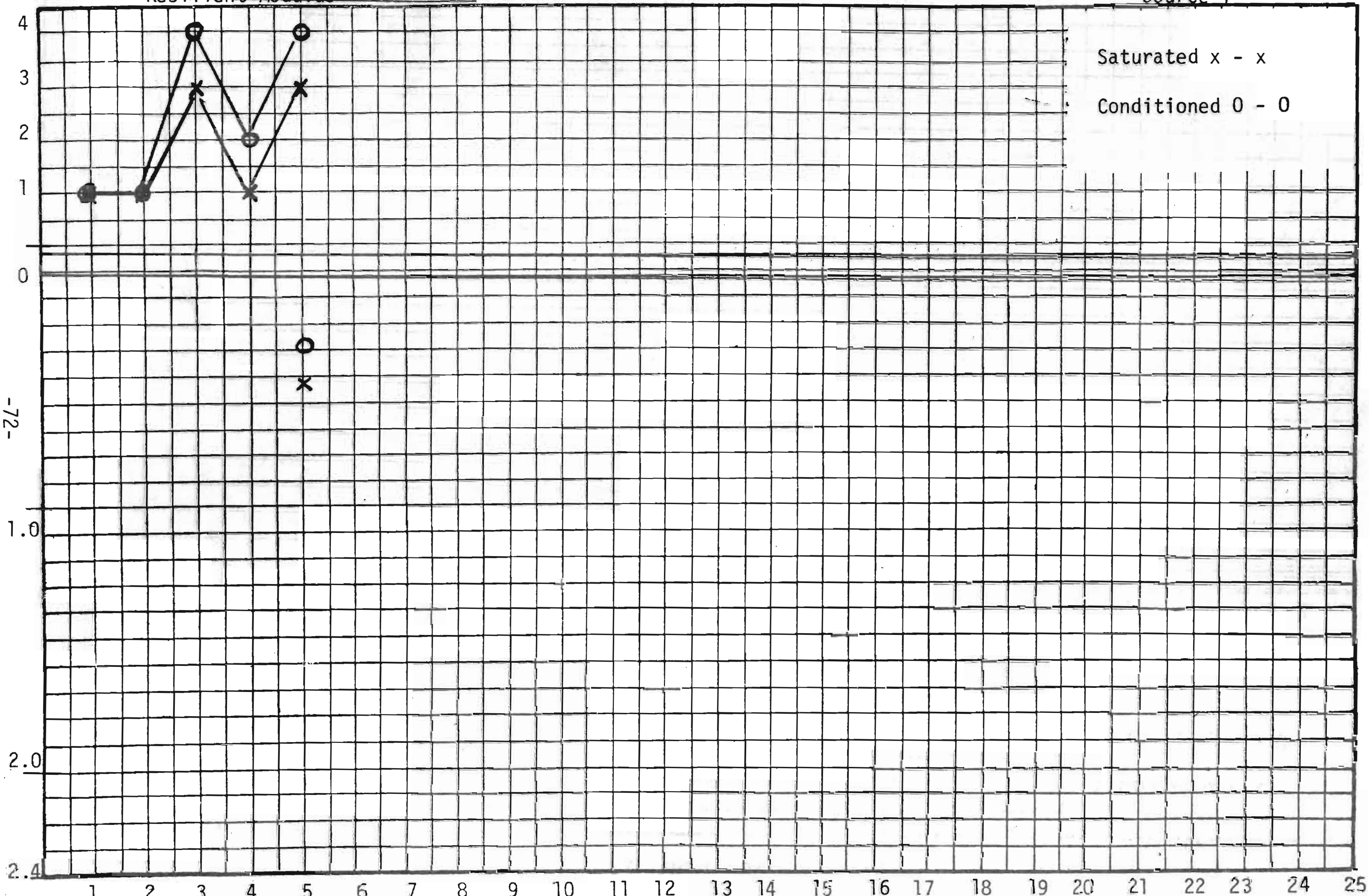


Divide - North

STATE HIGHWAY COMMISSION OF MONTANA

Test Resilient Modulus

Source 1

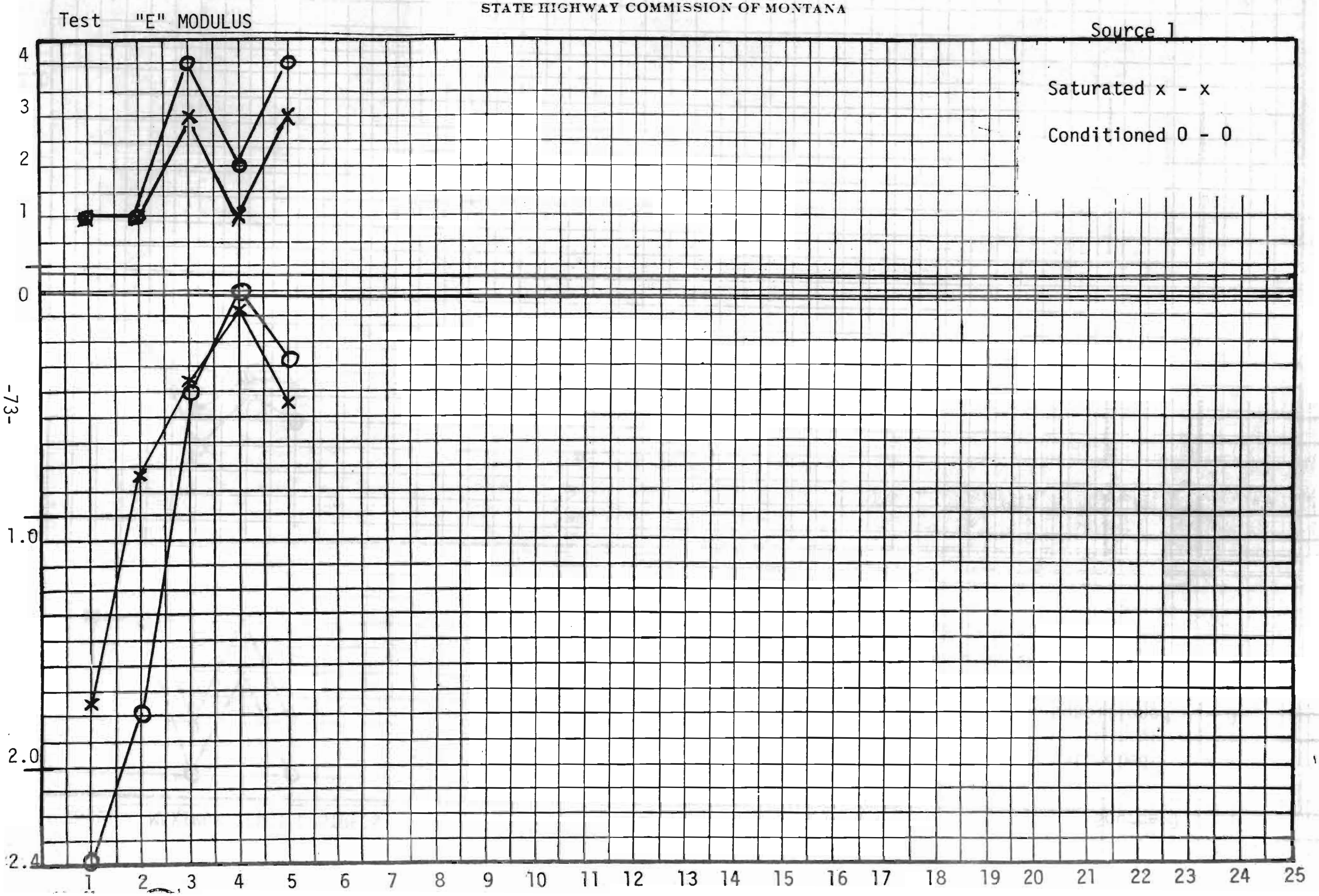


-72-

FORM 66

Divide - North

STATE HIGHWAY COMMISSION OF MONTANA

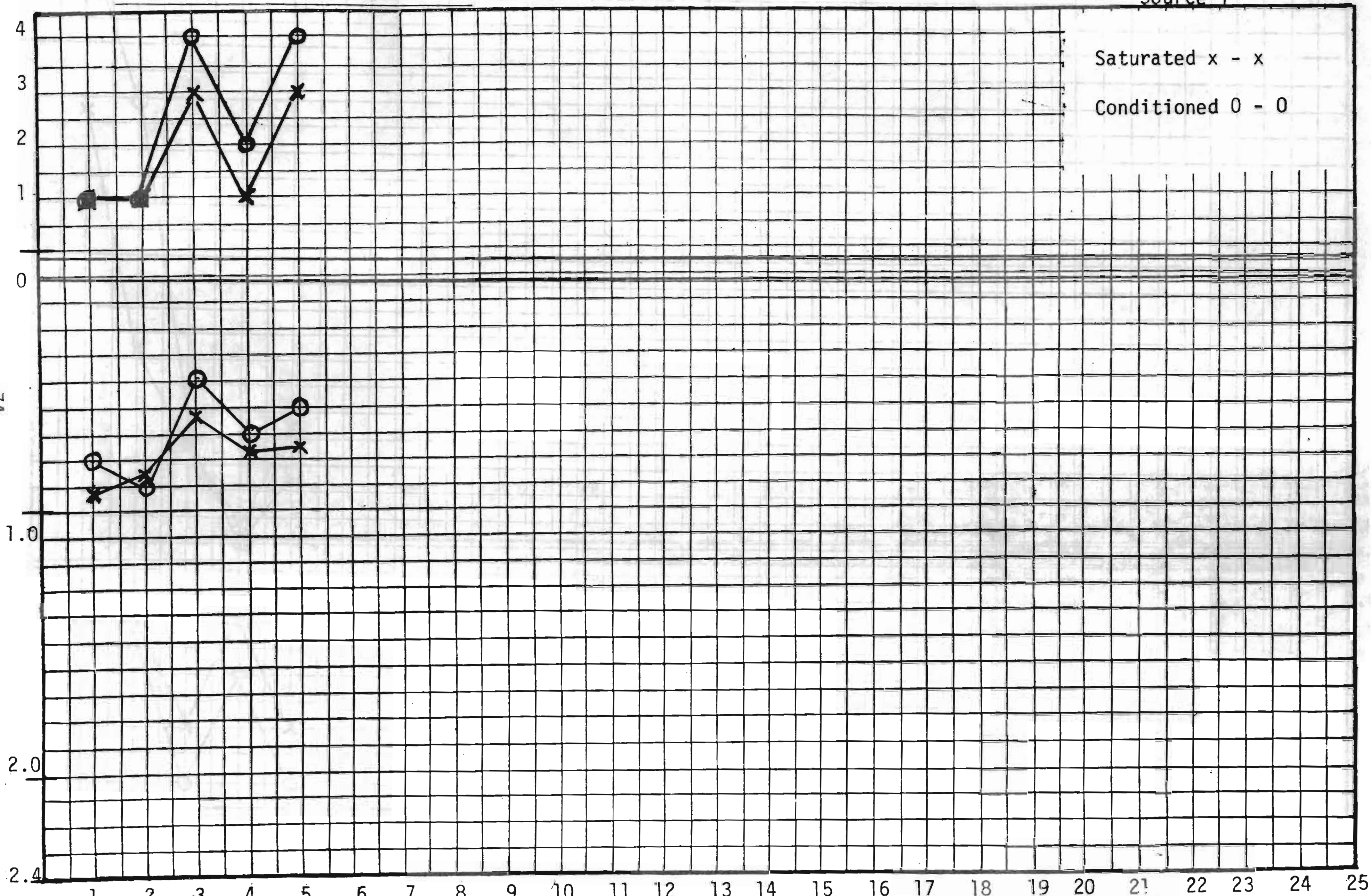


Divide - North

STATE HIGHWAY COMMISSION OF MONTANA

Test MAXIMUM TENSILE STRESS

Source 1



AGGREGATE SOURCE Teton River North & South

ASPHALT SOURCE Phillips - 6.5% except where noted

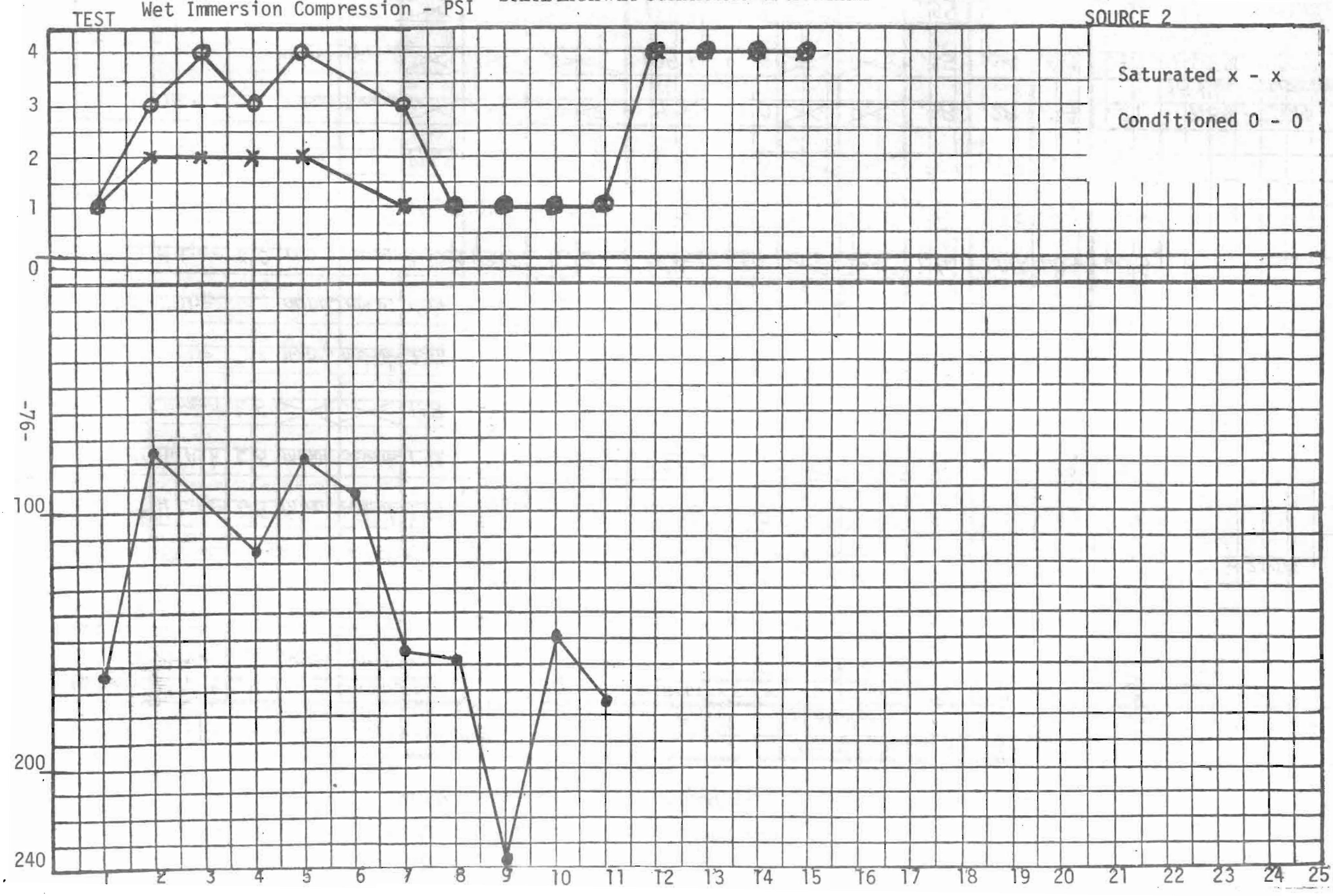
200M % 8.6 except where noted in remarks

STATE HIGHWAY COMMISSION OF MONTANA

Group SAMPLE NUMBER	FILLER TYPE	FILLER %	STRIPPING SAT	STRIPPING COND.	IMMERSION COMPRESSION DRY	IMMERSION COMPRESSION WET	IMMERSION COMPRESSION RATIO	MARSHALL STABILITY	MARSHALL FLOW	MODULUS OF RES RATIO SAT	MODULUS OF RES RATIO COND.	E MODULUS RATIO SAT	E MODULUS RATIO COND.	TENSILE STRESS RATIO SAT	TENSILE STRESS RATIO COND.	REMARKS
1	none		none	none	294.2	162.6	.552	2112	9			.42	.24	.74	.66	17.3% - 200M
2	none		minor	moderate	152.8	74.6	.488	1173	8			.32	.08	.50	.125	0
3	none		minor	severe				757	7			.21	.26	.51	.28	0% - 200M
4	H Lime	1.5	minor	moderate	157	115	.735	1505	8			.61	.31	.92	.55	
5	Fly Ash	1.5	minor	Severe	132.9	78.0	.587	1463	7			.56	.21	.69	.35	
6	Cement	1.5			158.6	92.3	.582	1375	8			.25	.18	.56	.52	
7	none		none	moderate	237.7	153.6	.646	1830	16			.72	.70	.86	.49	17.3% - 200M
8	none		none	none	196.7	158.8	.807	1173	14			.90	.98	1.02	1.02	
9	H Lime	6.0	none	none	230.3	238.2	1.035	1642	16			1.16	1.005	1.04	.83	
10	Fly Ash	6.0	none	none	147.8	149.1	1.01	1337	9			.73	.35	.94	.49	
11	Cement	6.0	none	none	174.8	173.9	.992	1667	10			.967	.58	.68	.625	
12	none		Severe	Severe				953	10			.48	.28	.24	.21	17.3% - 200M 15 blow compaction
13	none		severe	Severe				1091	12			.45	.34	.40	.19	17.3% - 200M 20 blow compaction
14	none		Severe	Severe				1157	9			.59	.17	.69	.21	17.3% - 200M 25 blow compaction
15	none		Severe	Severe				1386	8			.99	.32	.87	.36	17.3% - 200M 30 blow compaction

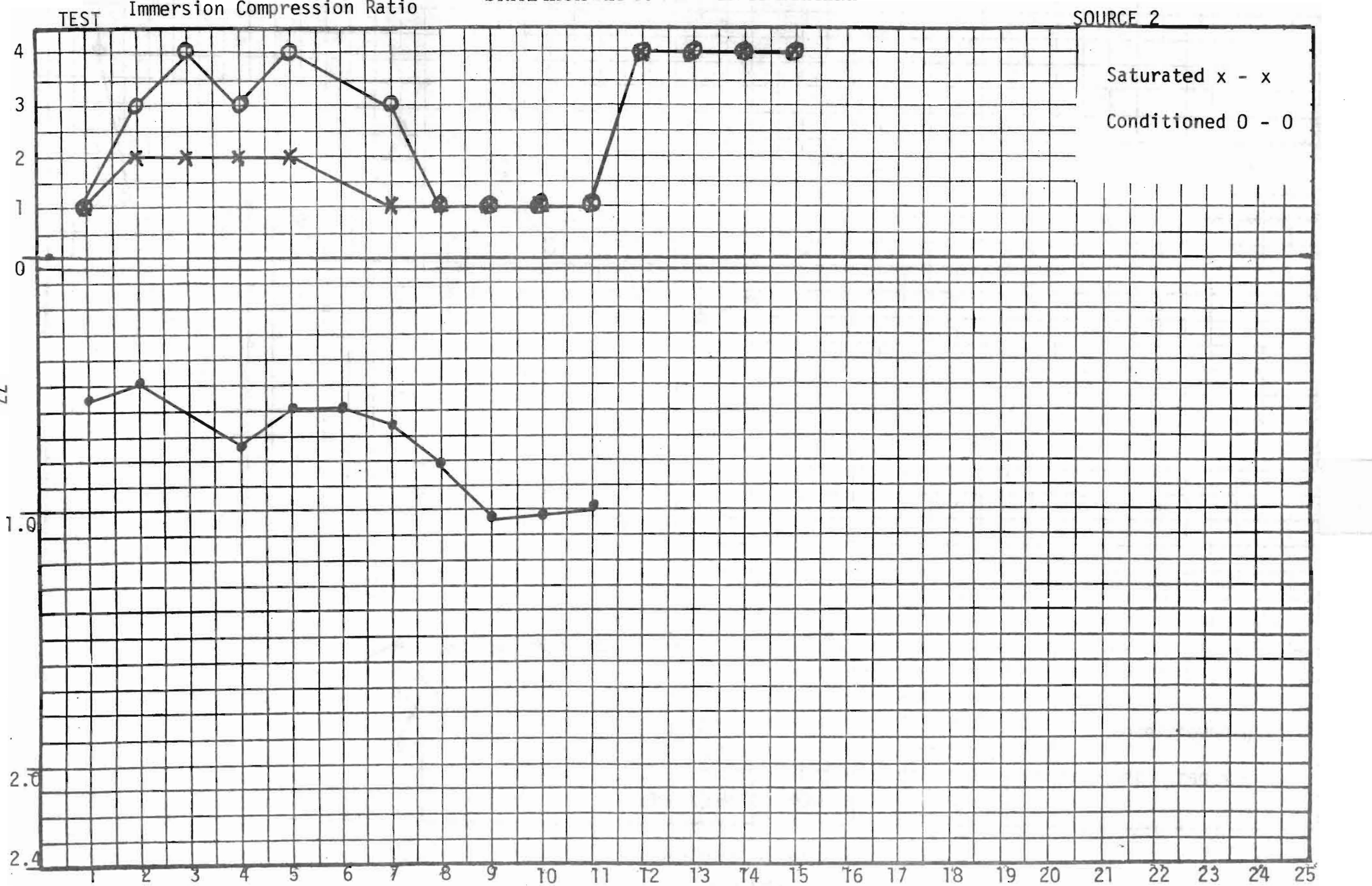
TETON RIVER - NORTH AND SOUTH

STATE HIGHWAY COMMISSION OF MONTANA



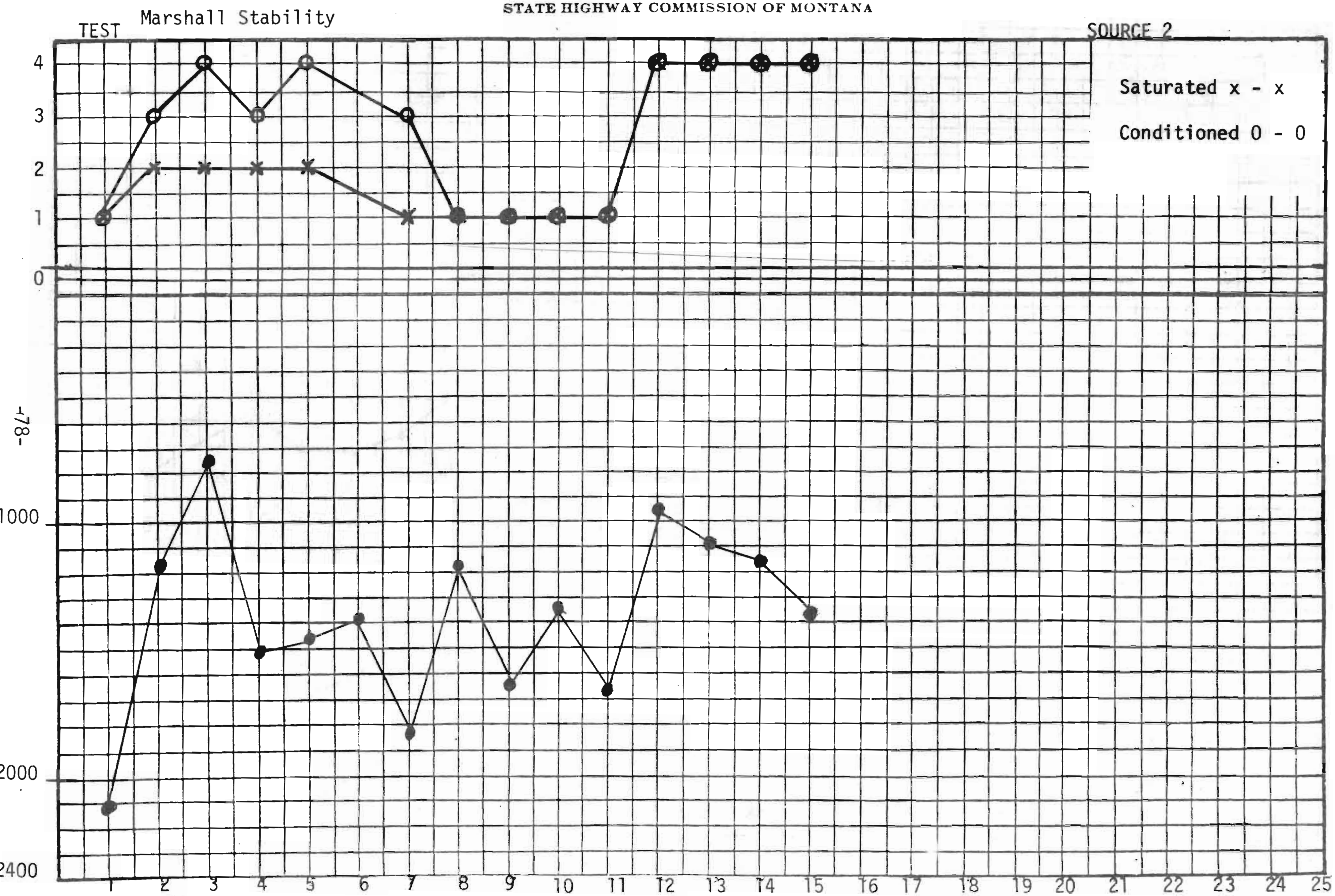
TETON RIVER - NORTH AND SOUTH

STATE HIGHWAY COMMISSION OF MONTANA



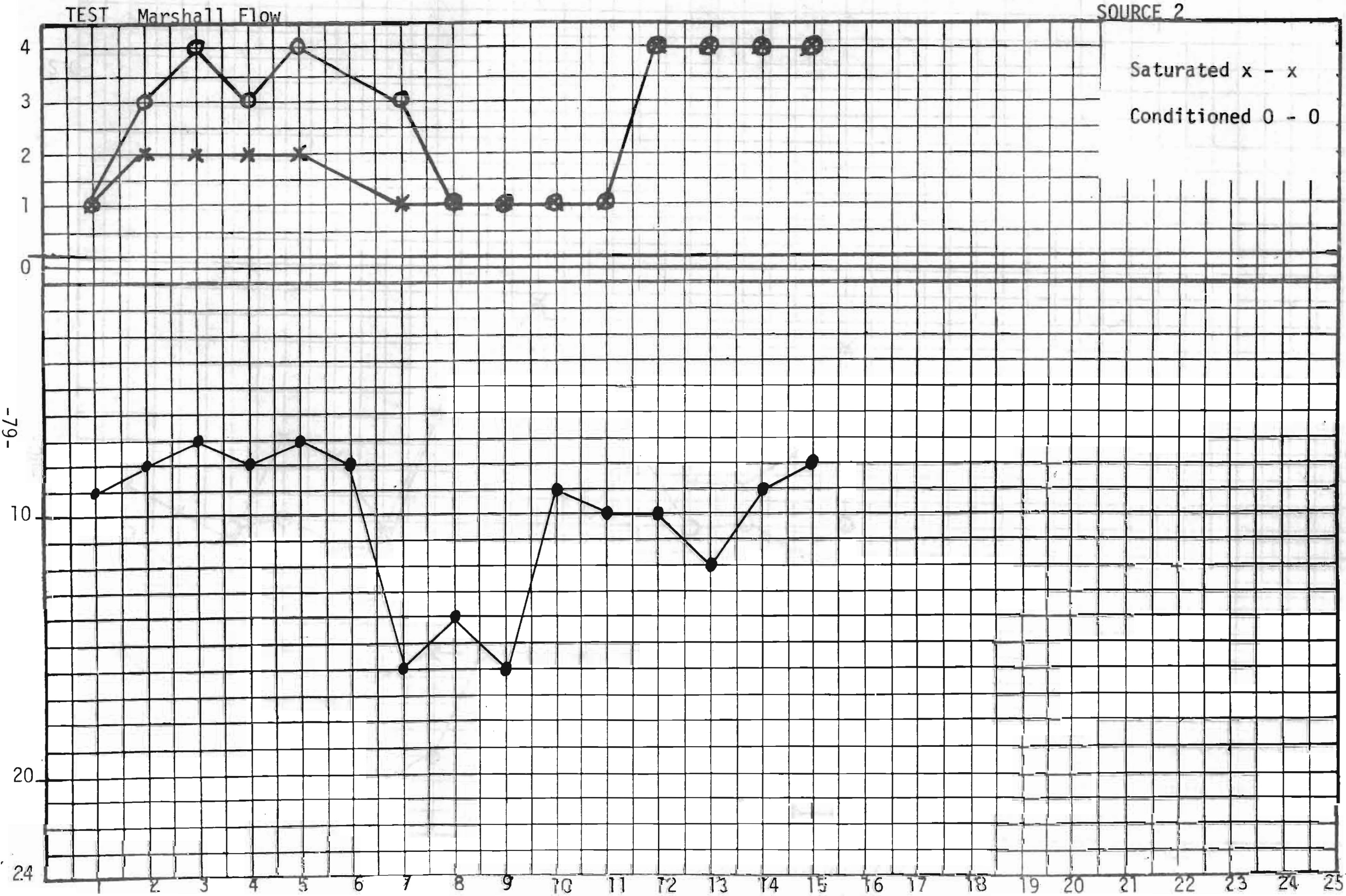
TETON RIVER - NORTH AND SOUTH

STATE HIGHWAY COMMISSION OF MONTANA



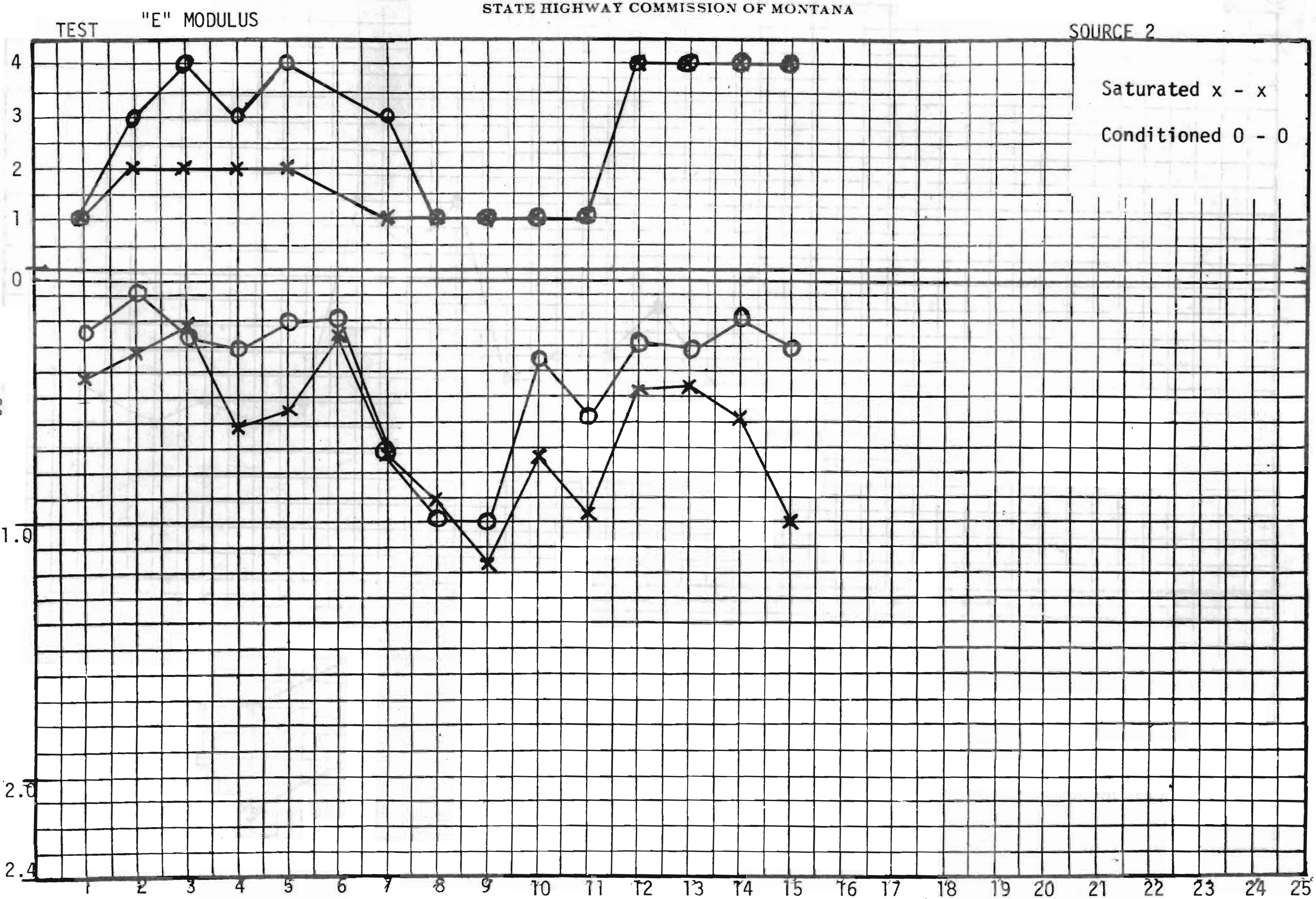
TETON RIVER - NORTH AND SOUTH

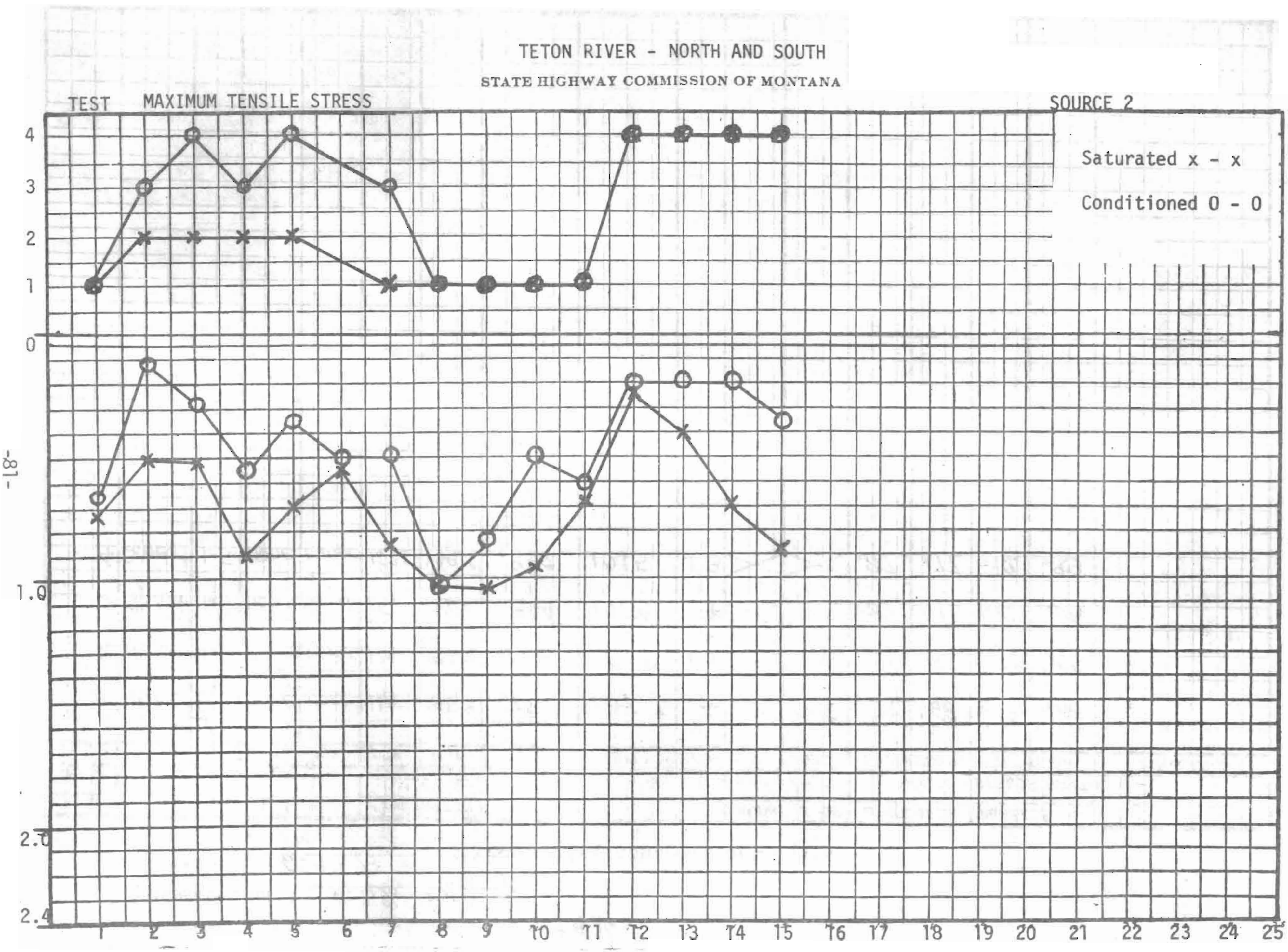
STATE HIGHWAY COMMISSION OF MONTANA



TETON RIVER - NORTH AND SOUTH

STATE HIGHWAY COMMISSION OF MONTANA




TETON RIVER - NORTH AND SOUTH
STATE HIGHWAY COMMISSION OF MONTANA
TEST
MAXIMUM TENSILE STRESS
SOURCE 2
Saturated x - x
Conditioned 0 - 0
4
3
2
1
0
1.0
2.0
2.4
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25

AGGREGATE SOURCE Frenchtown East & West

ASPHALT SOURCE 6.5% Phillips

200M % 6.93%

STATE HIGHWAY COMMISSION OF MONTANA

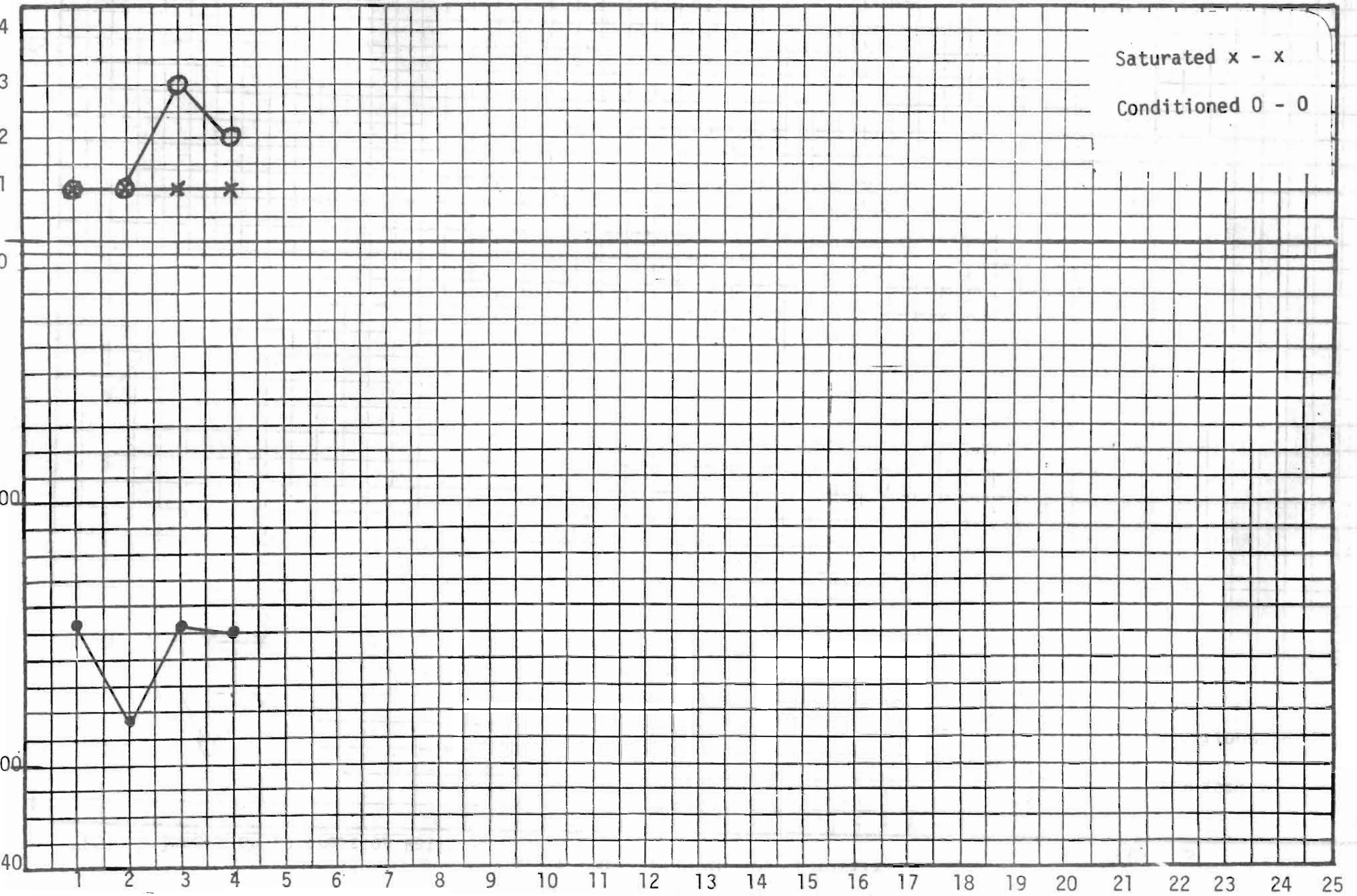
Group SAMPLE NUMBER	FILLER TYPE	FILLER %	STRIPPING SAT	STRIPPING COND.	IMMERSION COMPRESSION DRY	IMMERSION COMPRESSION WET	IMMERSION COMPRESSION RATIO	MARSHALL STABILITY	MARSHALL FLOW	MODULUS OF RES RATIO SAT	MODULUS OF RES RATIO COND.	E MODULUS RATIO SAT	E MODULUS RATIO COND.	TENSILE STRESS RATIO SAT	TENSILE STRESS RATIO COND.	REMARKS
1	none		none	none	114	145.9	1.28	1407	4			.39	.68	.79	.88	
2	H Lime	1.5	none	none	174	182.2	1.048	1019	15			.64	.96	1.09	1.00	
3	Fly Ash	1.5	none	moderate	156	147.2	.944	10.54	14			.87	1.15	1.12	1.08	
4	Cement	1.5	none	minor	157.6	149.6	.952	1015	13			.87	.77	.92	.93	

FRENCHTOWN - EAST AND WEST

STATE HIGHWAY COMMISSION OF MONTANA

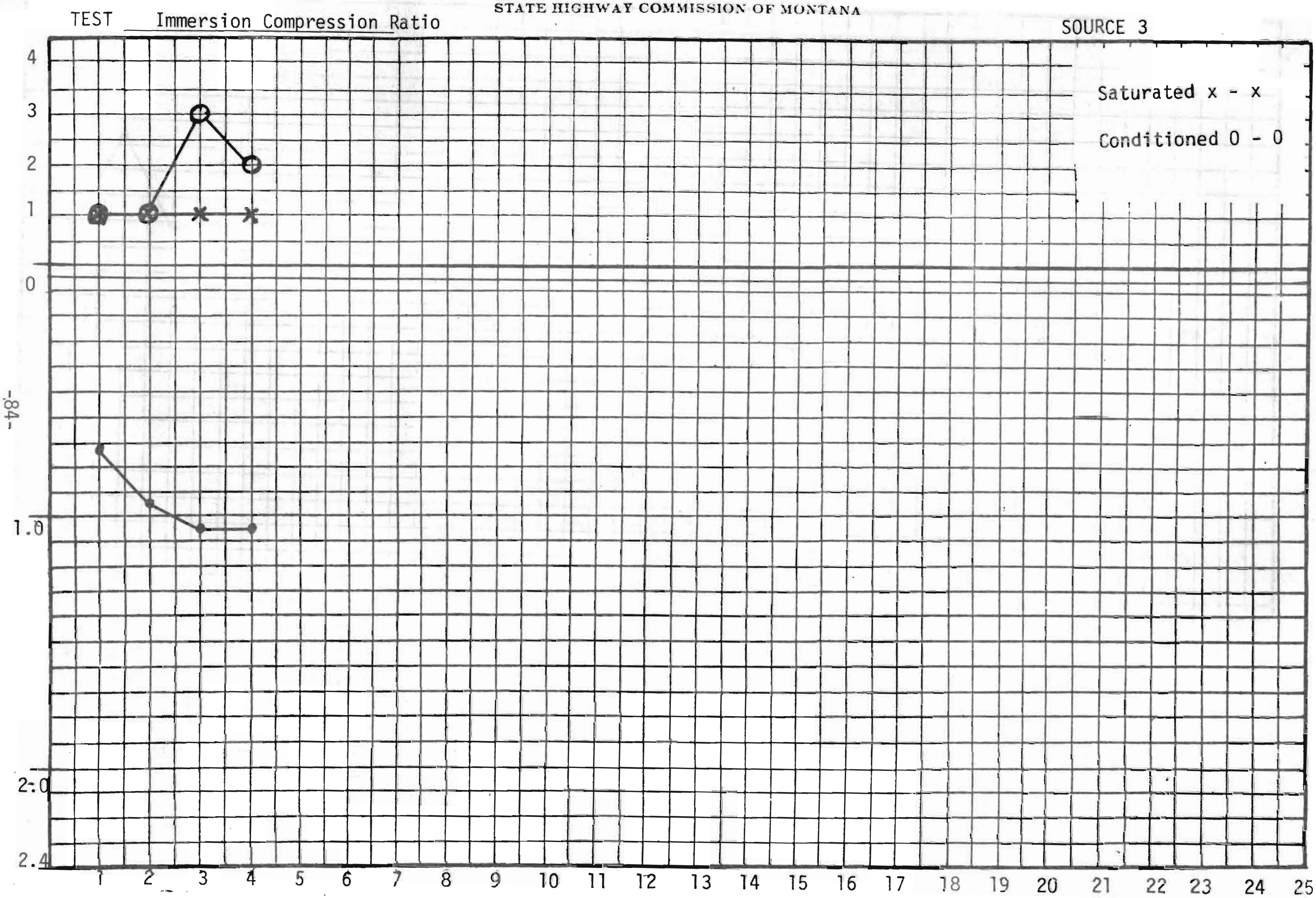
TEST Wet Immersion Compression - PSI

SOURCE 3



FRENCHTOWN - EAST AND WEST

STATE HIGHWAY COMMISSION OF MONTANA

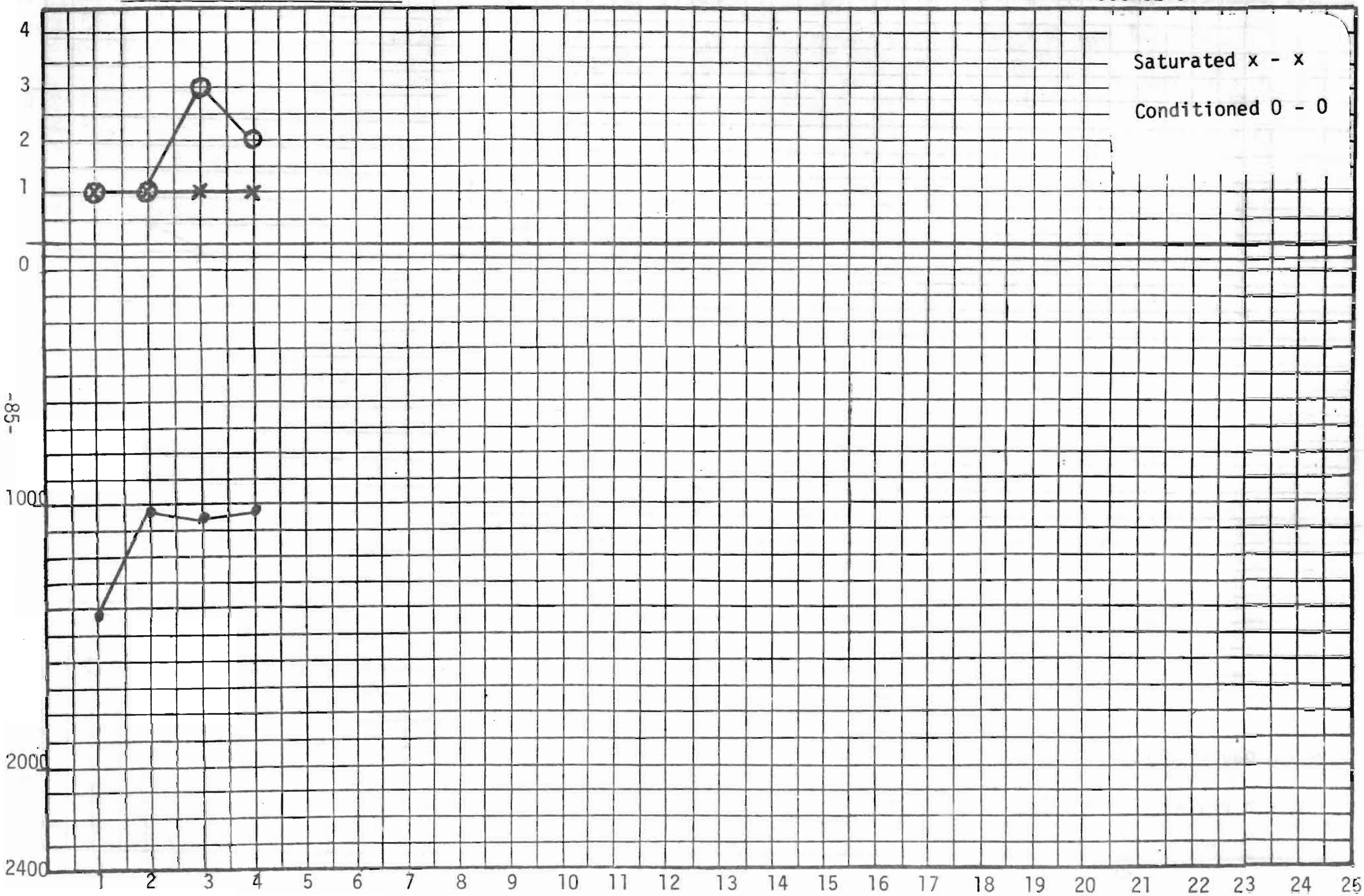


FRENCHTOWN - EAST AND WEST

STATE HIGHWAY COMMISSION OF MONTANA

TEST Marshall Stability

SOURCE 3

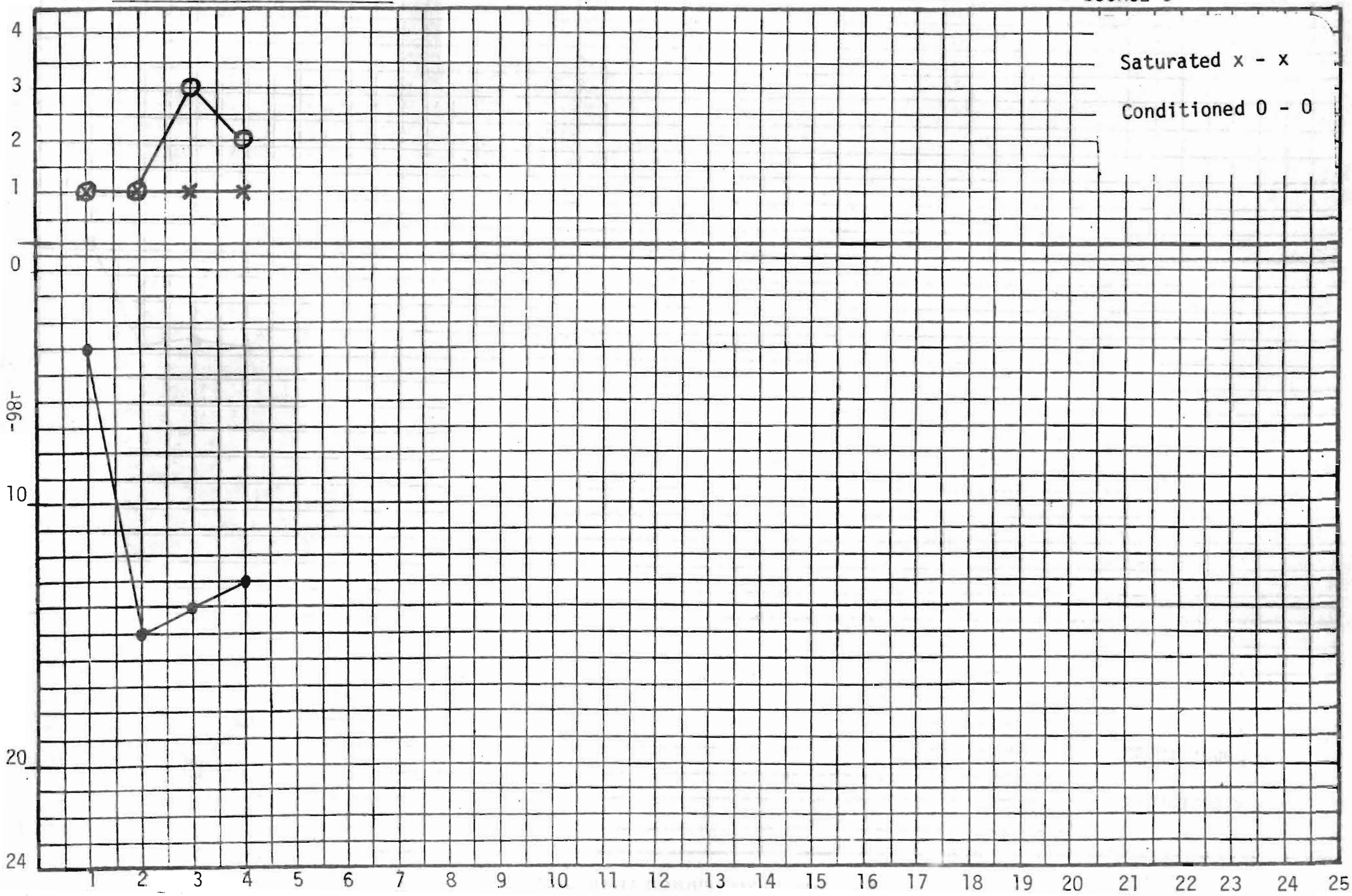


FRENCHTOWN - EAST AND WEST

STATE HIGHWAY COMMISSION OF MONTANA

TEST Marshall Flow

SOURCE 3

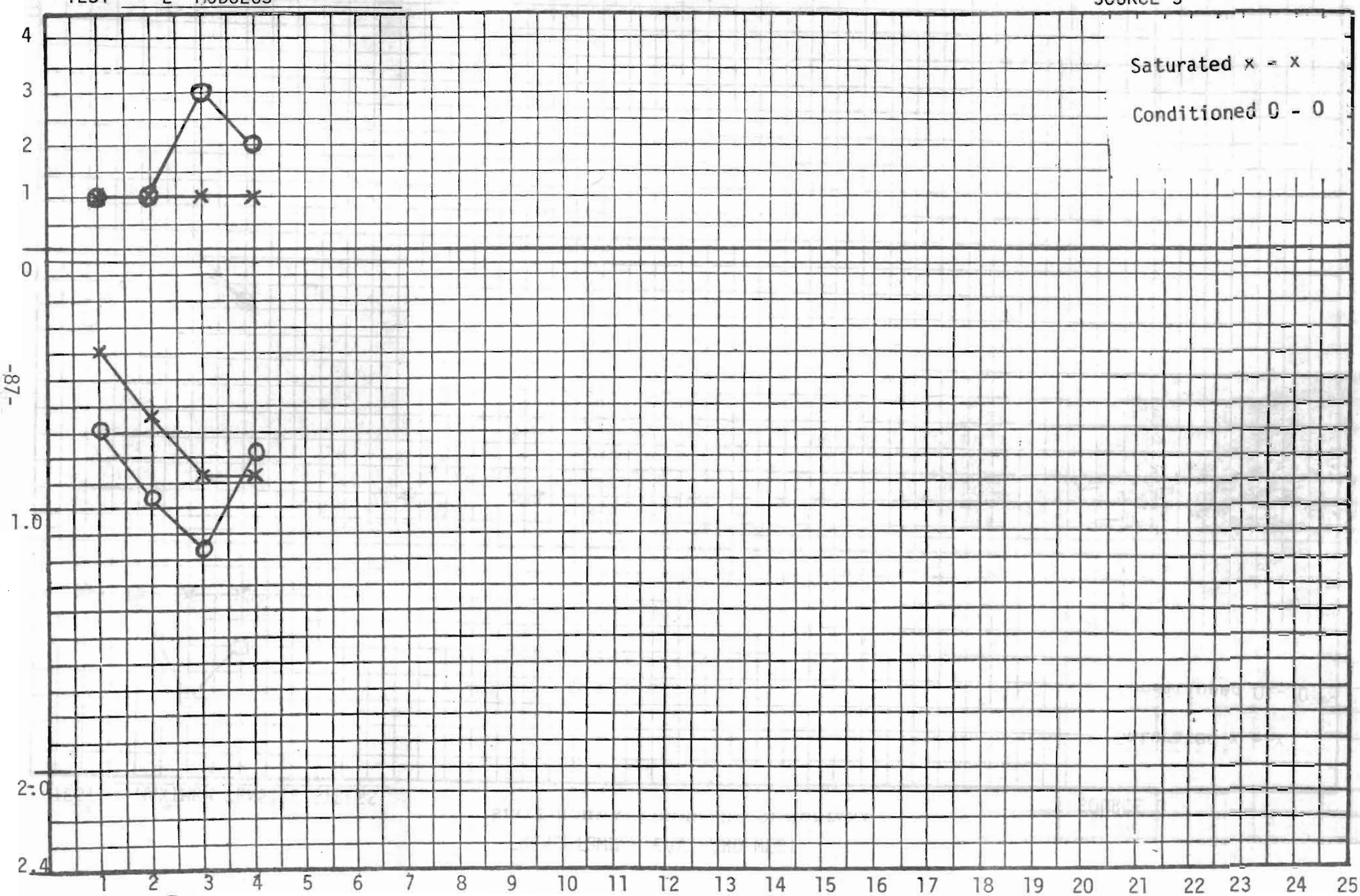


FRENCHTOWN - EAST AND WEST

STATE HIGHWAY COMMISSION OF MONTANA

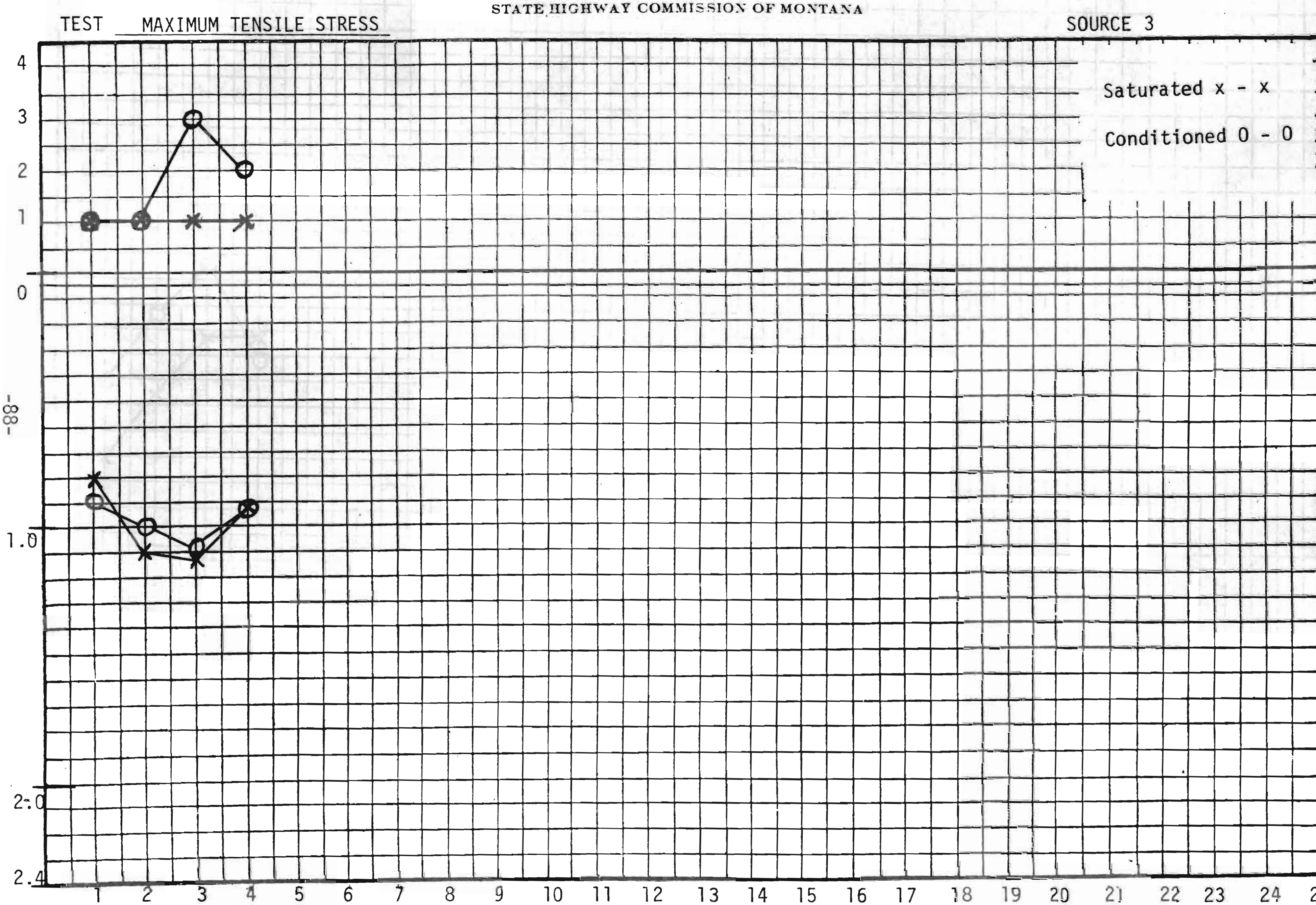
TEST "E" MODULUS

SOURCE 3



FRENCHTOWN - EAST AND WEST

STATE HIGHWAY COMMISSION OF MONTANA



AGGREGATE SOURCE Forsyth East & West

ASPHALT SOURCE Phillips-except where noted in remarks

200M % 4.6

STATE HIGHWAY COMMISSION OF MONTANA

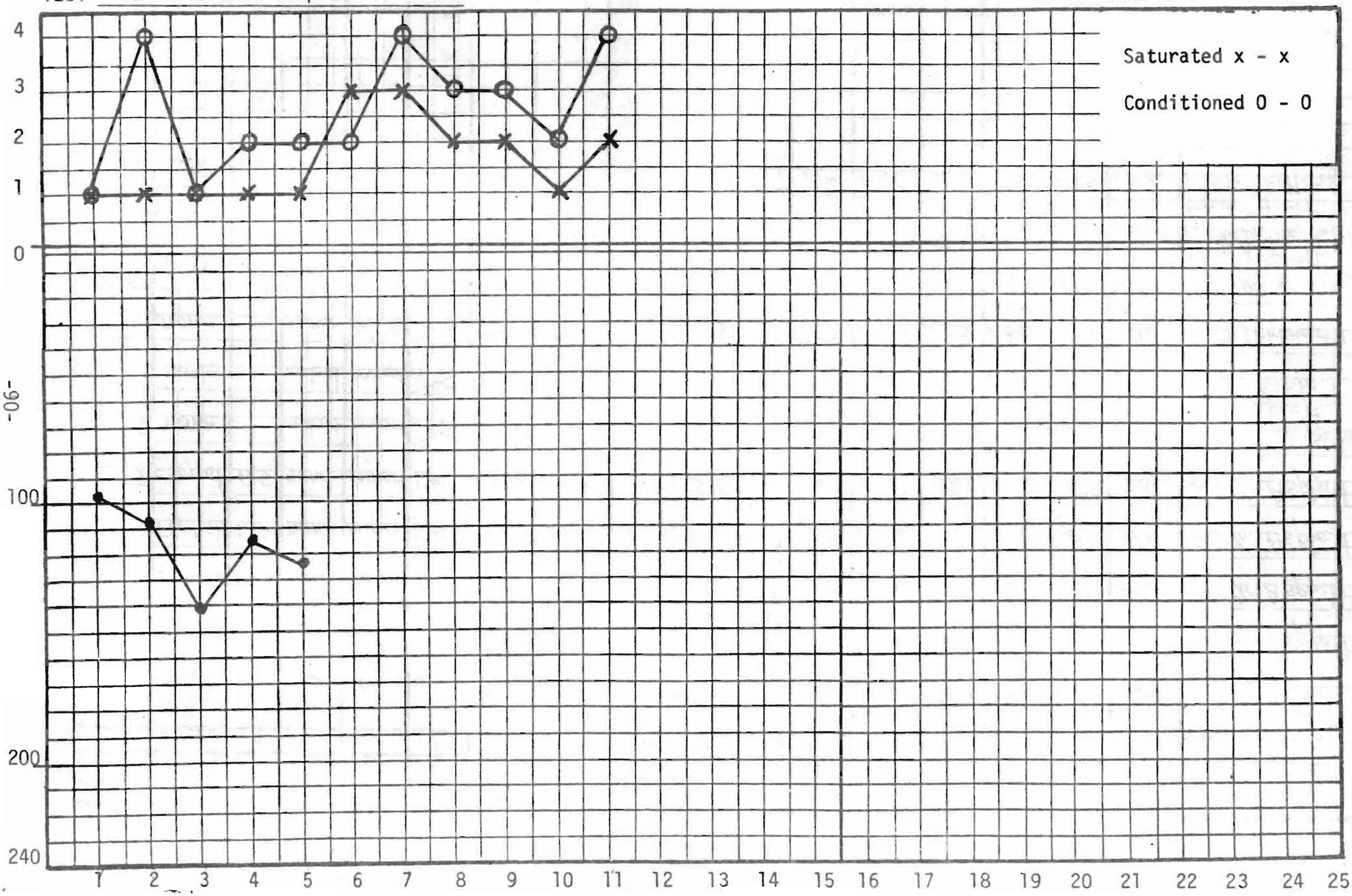
Group SAMPLE NUMBER	FILLER TYPE	FILLER %	STRIPPING SAT	STRIPPING COND.	IMMERSION COMPRESSION DRY	IMMERSION COMPRESSION WET	IMMERSION COMPRESSION RATIO	MARSHALL STABILITY	MARSHALL FLOW	MODULUS OF RES RATIO SAT	MODULUS OF RES RATIO COND.	E MODULUS RATIO SAT	E MODULUS RATIO COND.	TENSILE STRESS RATIO SAT	TENSILE STRESS RATIO COND.	REMARKS
1	none		none	none	114.3	97.4	.85	1208	10			1.17	.67	1.01	1.04	6.2% Asphalt
2	none		none	severe	99.2	108.3	1.09	1106	9			.62	.36	.78	.50	5.7% Asphalt
3	H Lime	1.5	none	none	166.1	150.9	.909	1116	11	.88	.79	1.02	.79	.95	.93	6.2% Asphalt
4	Fly Ash	1.5	none	minor	134.2	125.5	.935	838	9	.79	.52	.29	.31	.89	.78	6.2% Asphalt
5	cement	1.5	none	minor	134.0	132.6	.99	1156	8	.40	.63	.35	.62	.69	.80	6.2% Asphalt
6	none		moderate	minor				795	7	.52	.74	.39	.49	.72	.80	reduced compaction 6.2% Asphalt
7	none		moderate	severe				1108	5	.47	.49	.41	.36	.64	.57	5.9% Asphalt
8	none		minor	moderate				1074	6	.45	.43	.33	.28	.69	.50	6.2% Continental A
9	none		minor	moderate				1735	6	.60	.56	.43	.30	.90	.77	85-100 Phillips 6.2% Asphalt
10	none		none	minor				1392	6	.75	.54	.73	.28	.95	.66	6.2% Continental-A special test
11	none		minor	severe				934	7	.74	.46	.69	.46	.85	.62	5.5% Phillips

FORSYTH - EAST AND WEST

STATE HIGHWAY COMMISSION OF MONTANA

TEST Wet Immersion Compression - PSI

Source 4

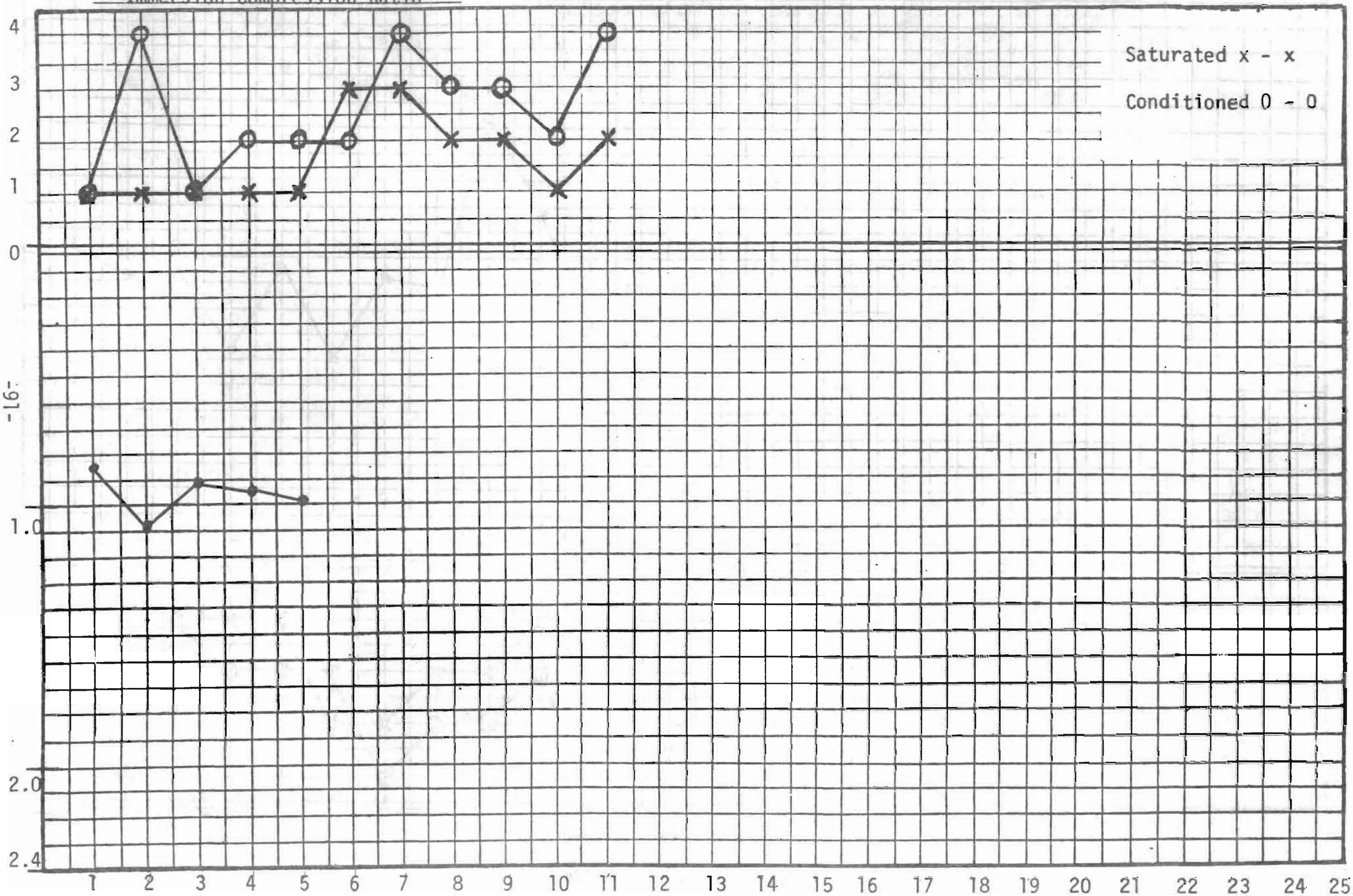


FORSYTH - EAST AND WEST

STATE HIGHWAY COMMISSION OF MONTANA

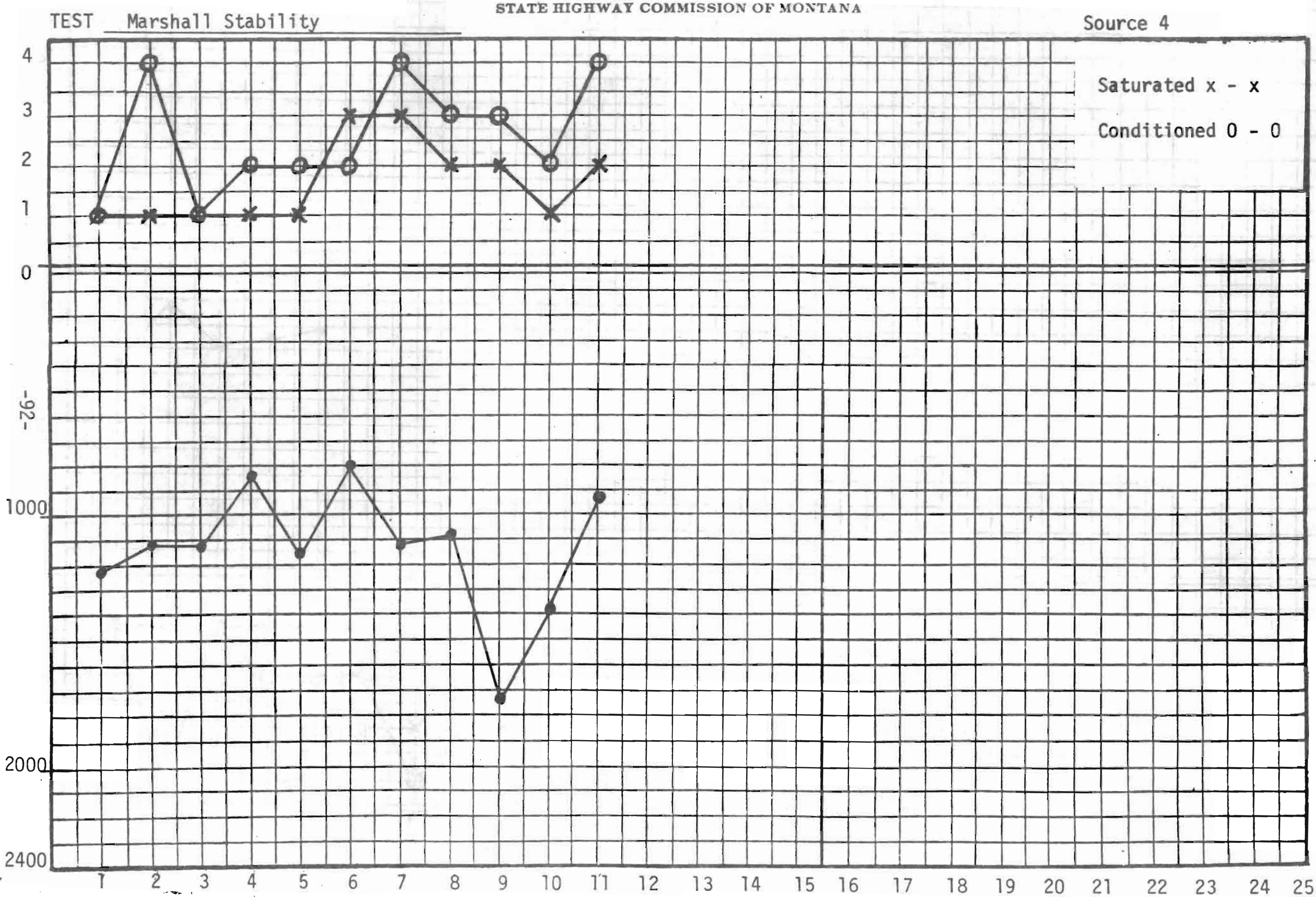
TEST Immersion Compression Ratio

Source 4



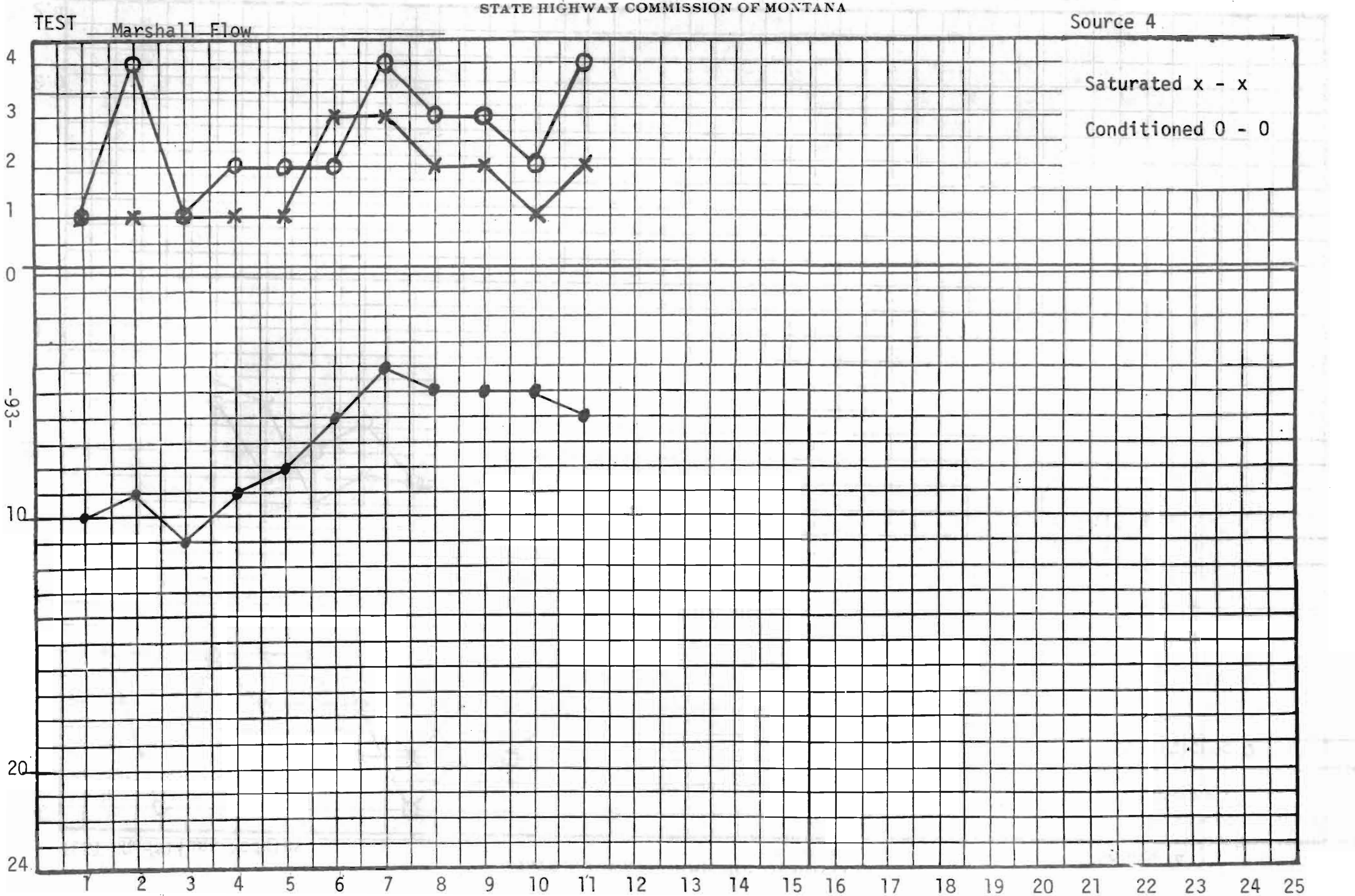
FORSYTH - EAST AND WEST

STATE HIGHWAY COMMISSION OF MONTANA



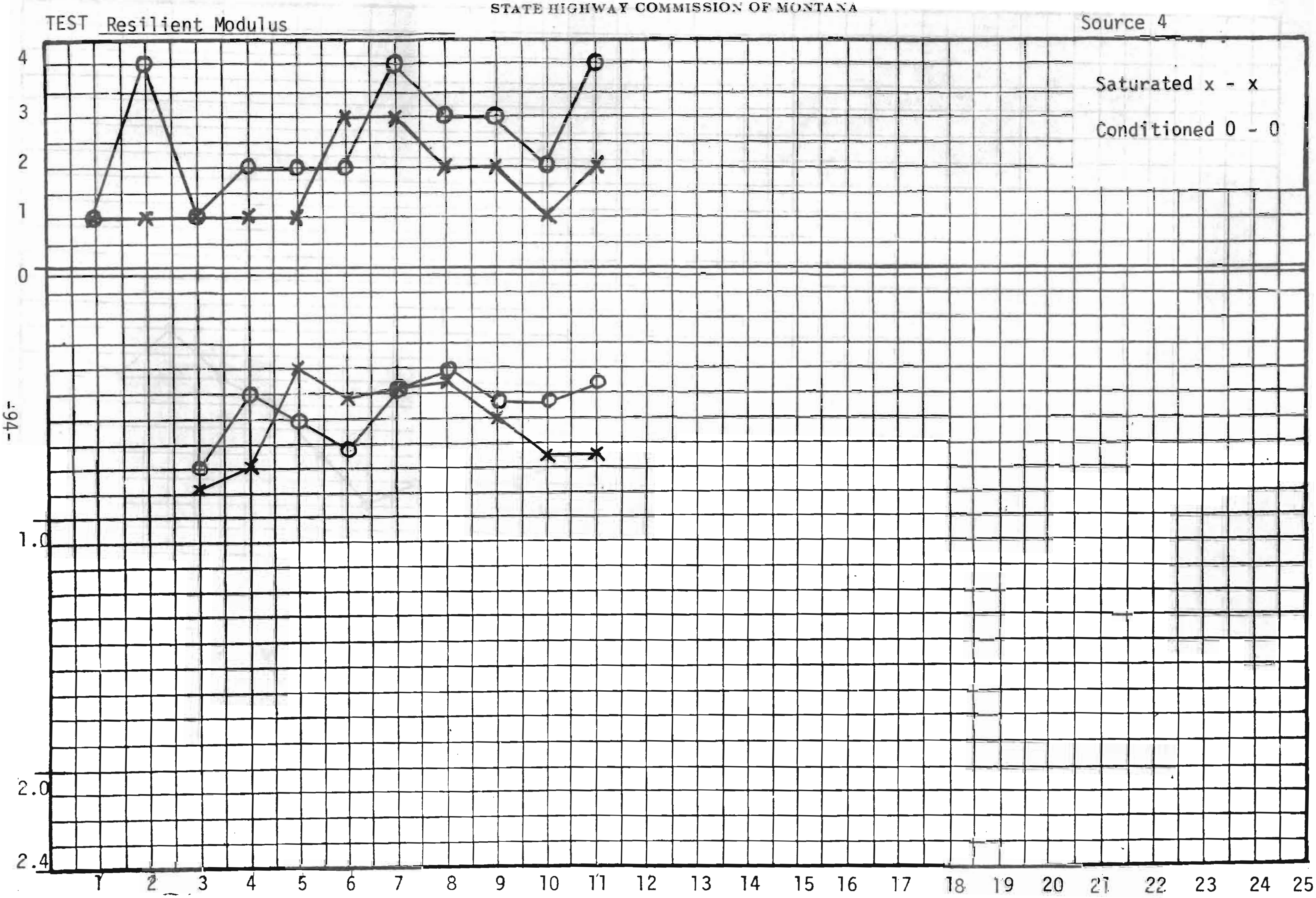
FORSYTH - EAST AND WEST

STATE HIGHWAY COMMISSION OF MONTANA



FORSYTH - EAST AND WEST

STATE HIGHWAY COMMISSION OF MONTANA

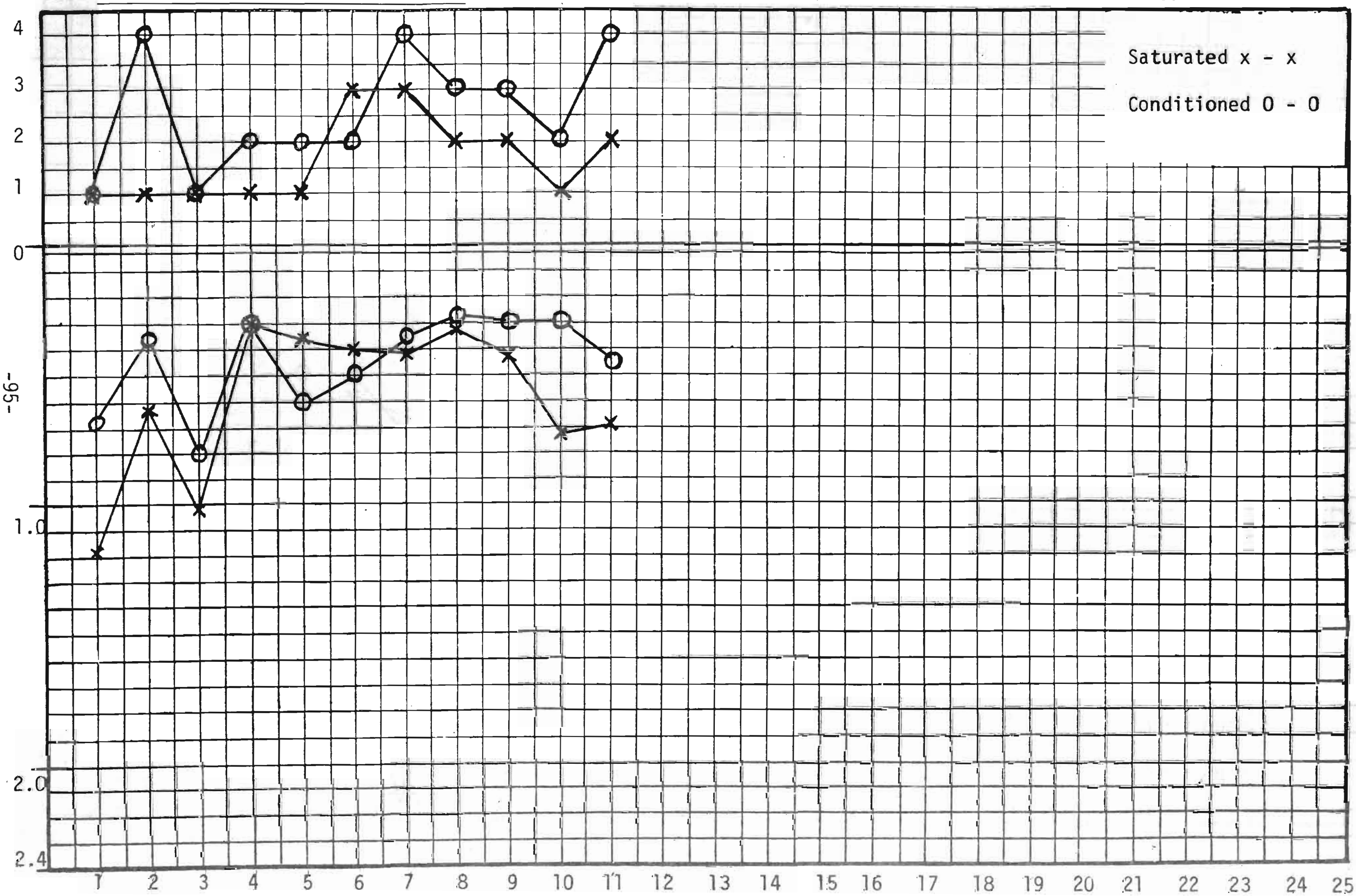


FORSYTH - EAST AND WEST

STATE HIGHWAY COMMISSION OF MONTANA

TEST "E" MODULUS

Source 4

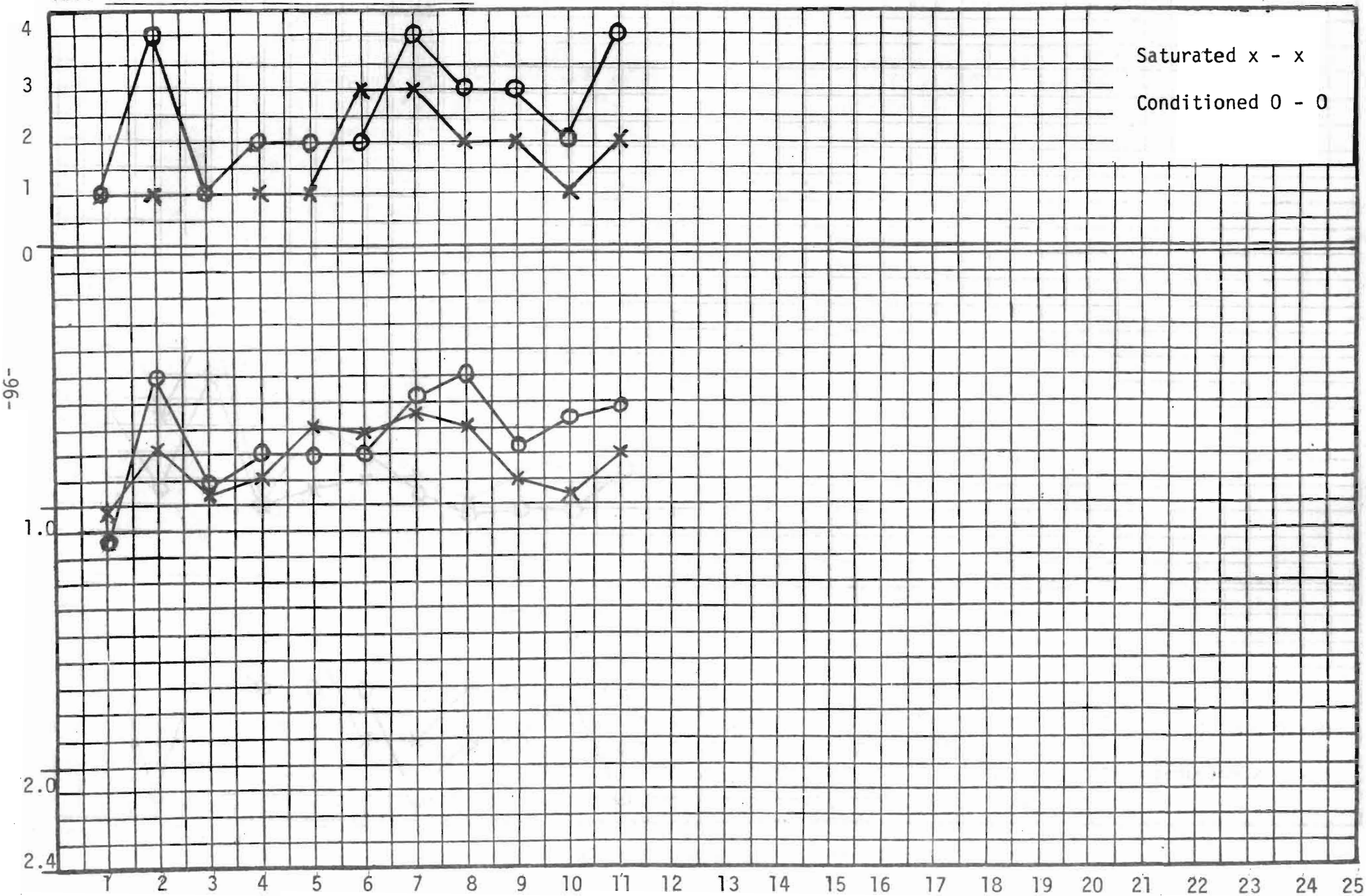


FORSYTH - EAST AND WEST

STATE HIGHWAY COMMISSION OF MONTANA

TEST MAXIMUM TENSILE STRESS

Source 4



AGGREGATE SOURCE Coal-Strip Lame Deer

ASPHALT SOURCE Continental

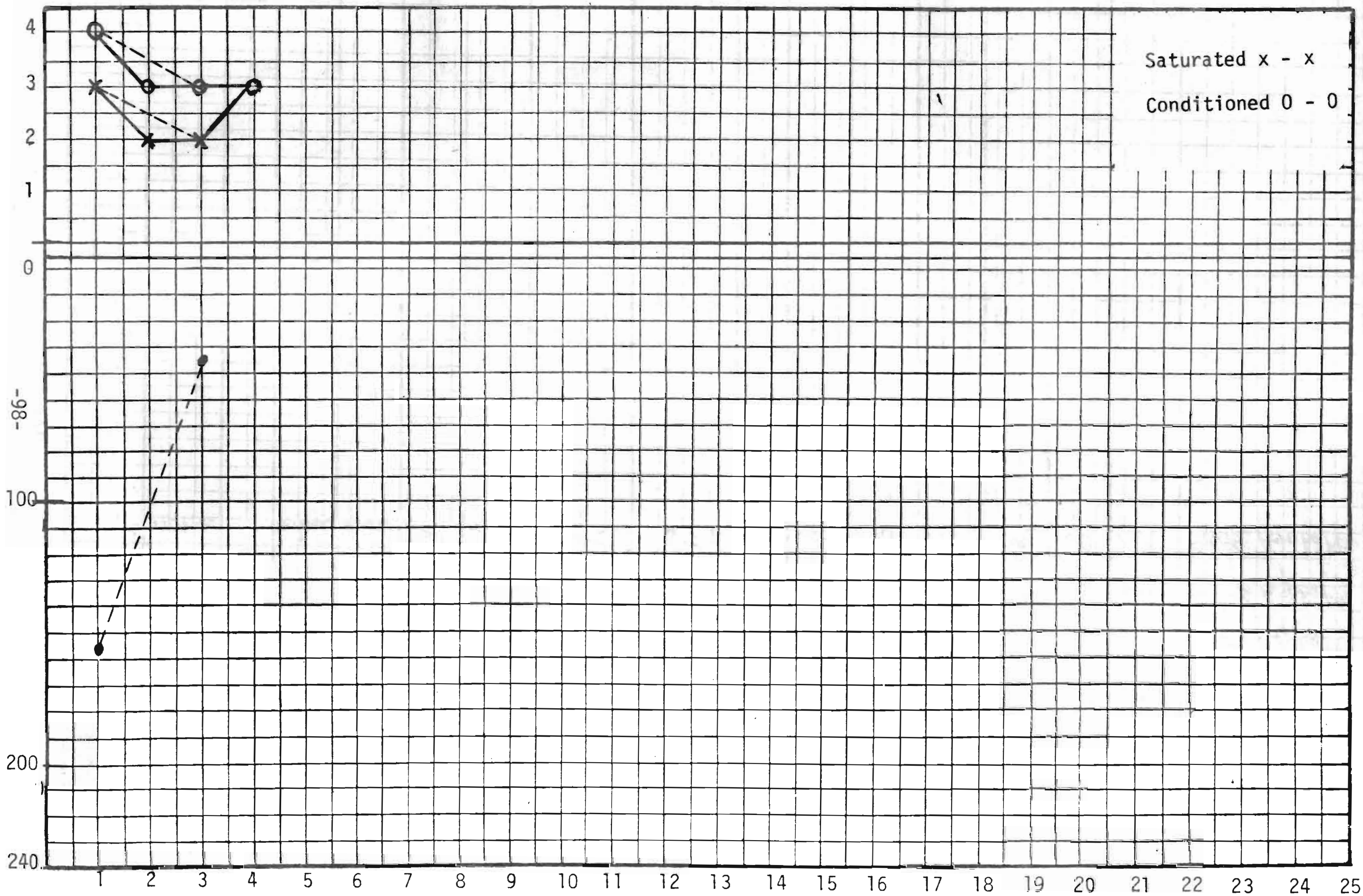
200M % 8.7

STATE HIGHWAY COMMISSION OF MONTANA

Group SAMPLE NUMBER	FILLER TYPE	FILLER %	STRIPPING SAT	STRIPPING COND.	IMMERSION COMPRESSION DRY	IMMERSION COMPRESSION WET	IMMERSION COMPRESSION RATIO	MARSHALL STABILITY	MARSHALL FLOW	MODULUS OF RES RATIO SAT	MODULUS OF RES RATIO COND.	E MODULUS RATIO SAT	E MODULUS RATIO COND.	TENSILE STRESS RATIO SAT	TENSILE STRESS RATIO COND.	REMARKS
1	none		moderate	severe	157.8	158.1	1.002	1003	13	.306	.089	.069	.016	.60	.15	8.5% Asphalt
2	H Lime	1.5	minor	moderate				1207	14	.59	.24	.19	.48	.72	.30	8.5% Asphalt
3	none		minor	moderate	36.6	46.55	1.27	1018	15	.30	.11	.25	.04	.52	.19	8.0% Asphalt
4	none		moderate	moderate				671	19	.31	.08	.25	.04	.60	.19	8.0% Asphalt

COALSTRIP - LAME DEER

TEST Wet Immersion Compression - PSI STATE HIGHWAY COMMISSION OF MONTANA SOURCE 5

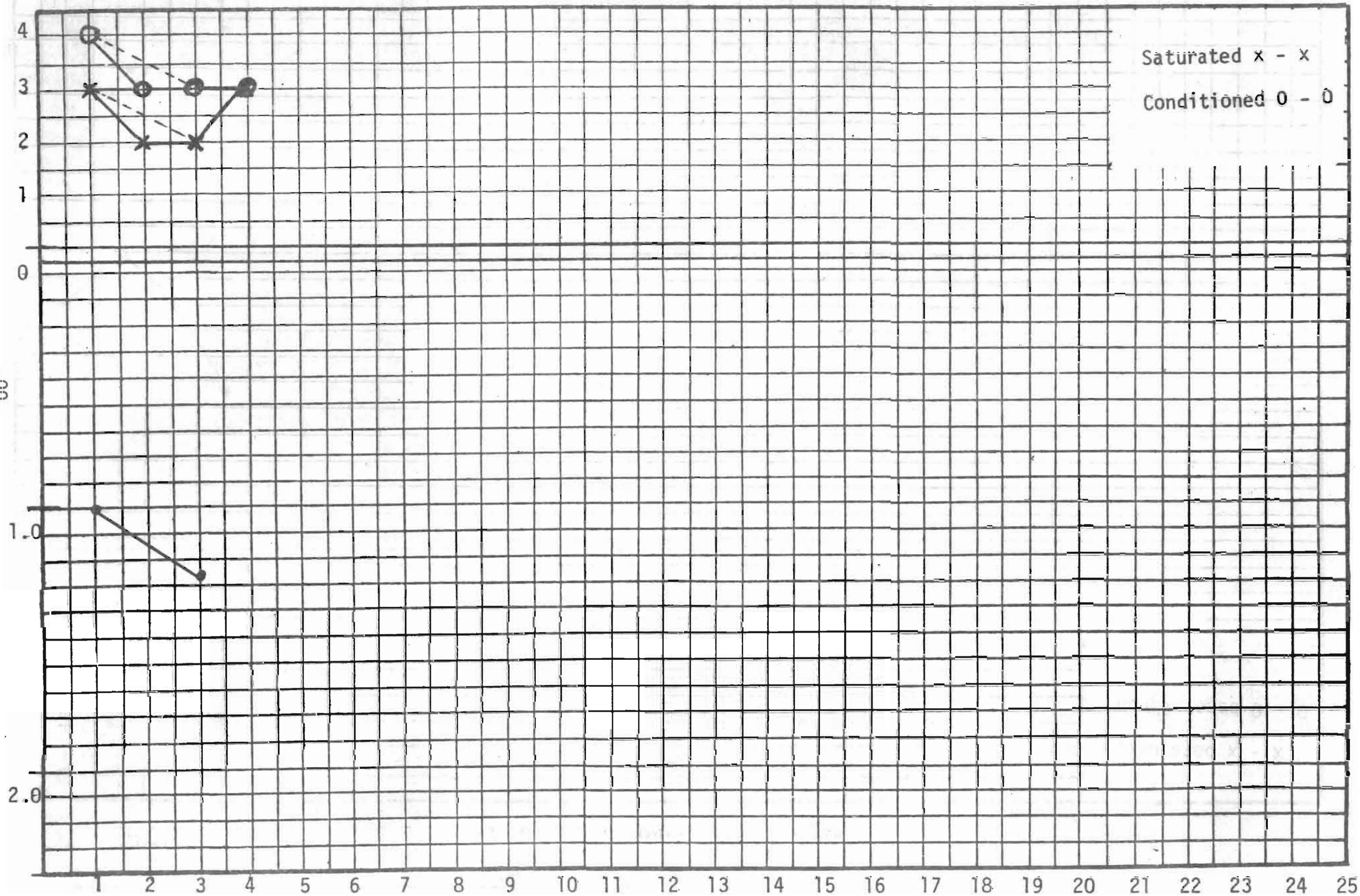


COALSTRIP - LAME DEER

TEST Immersion Compression Ratio

STATE HIGHWAY COMMISSION OF MONTANA

SOURCE 5

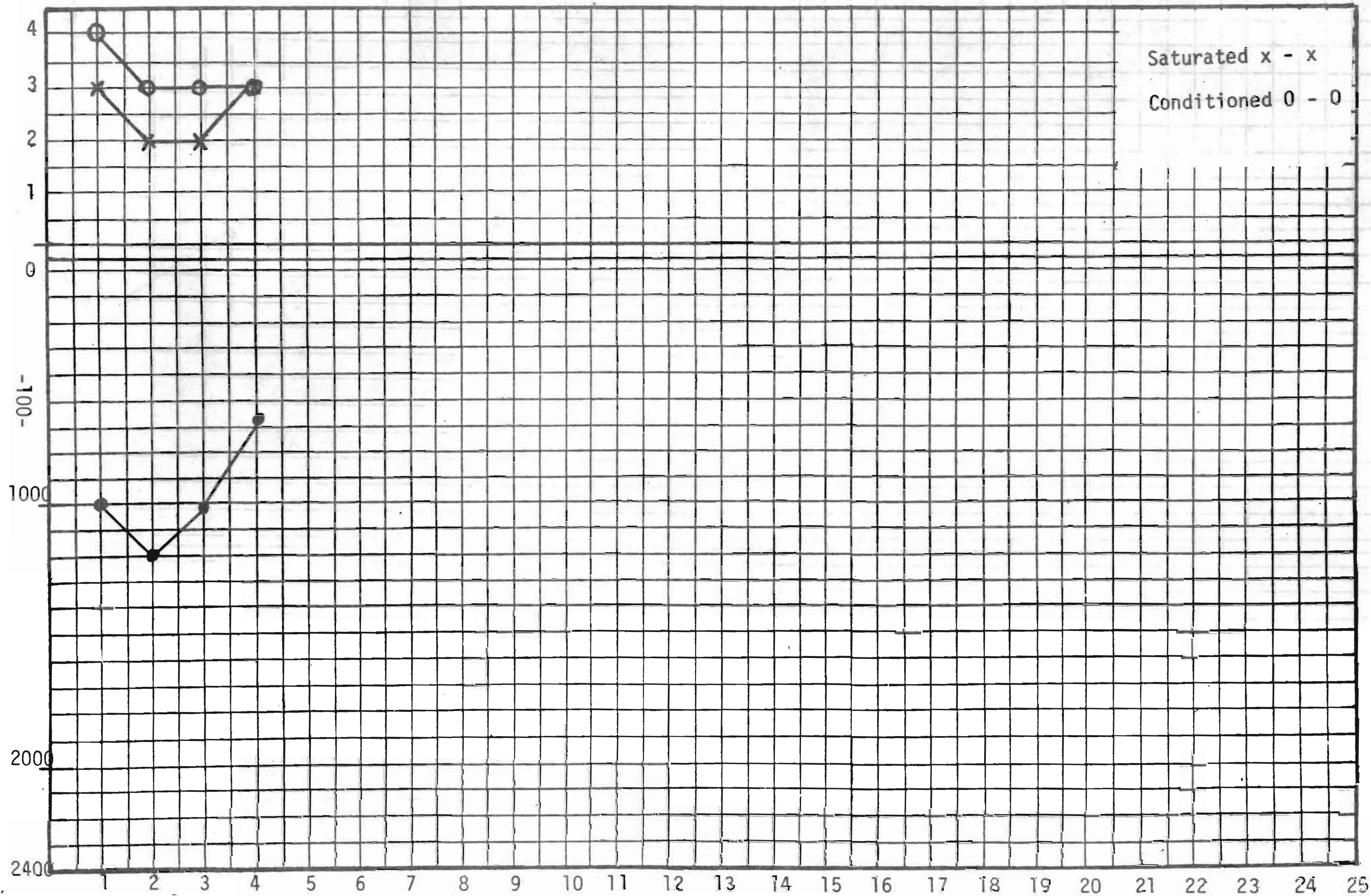


COALSTRIP - LAME DEER

TEST Marshall Stability

STATE HIGHWAY COMMISSION OF MONTANA

SOURCE 5

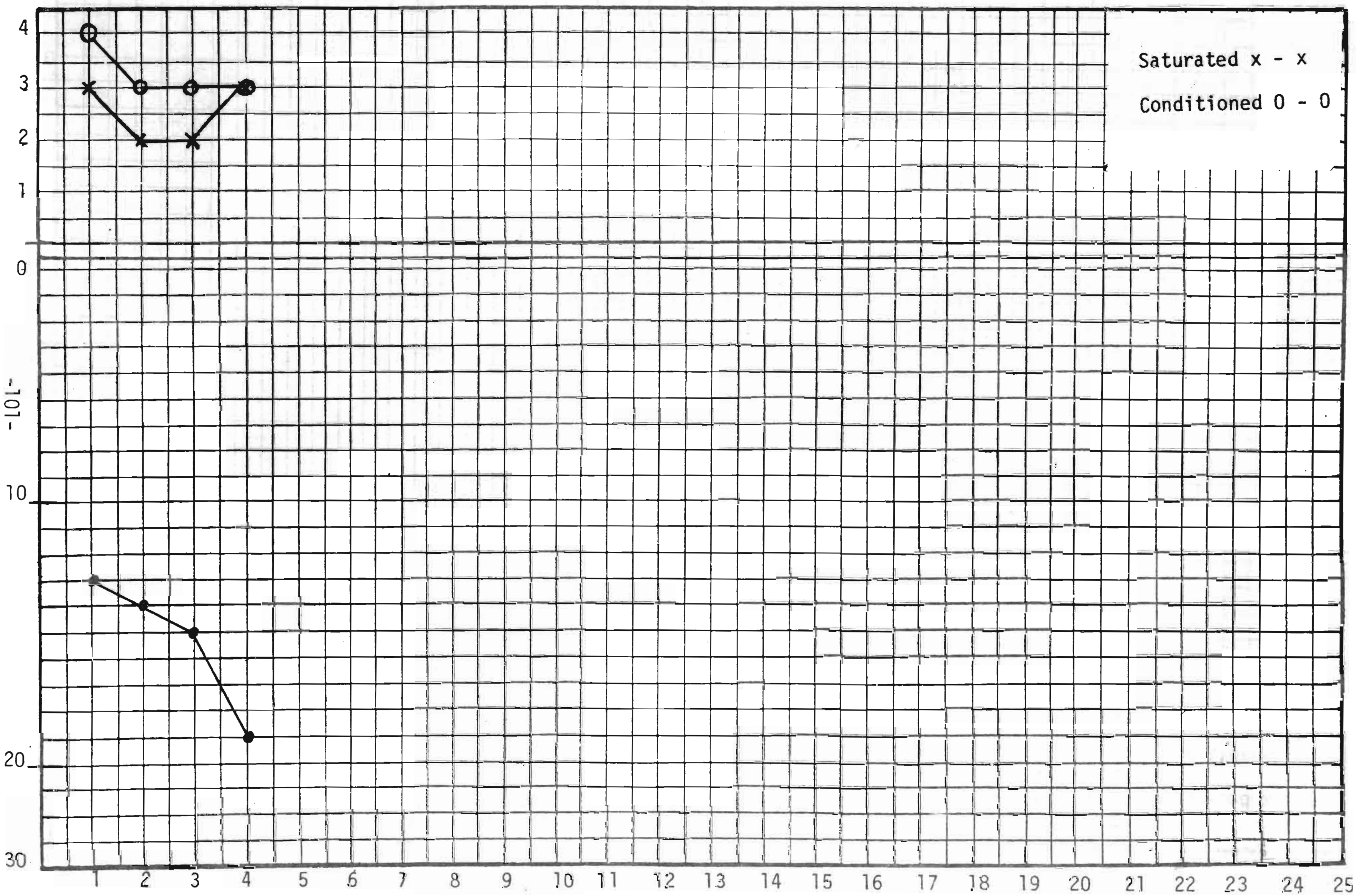


COALSTRIP - LAME DEER

TEST Marshall Flow

STATE HIGHWAY COMMISSION OF MONTANA

SOURCE 5

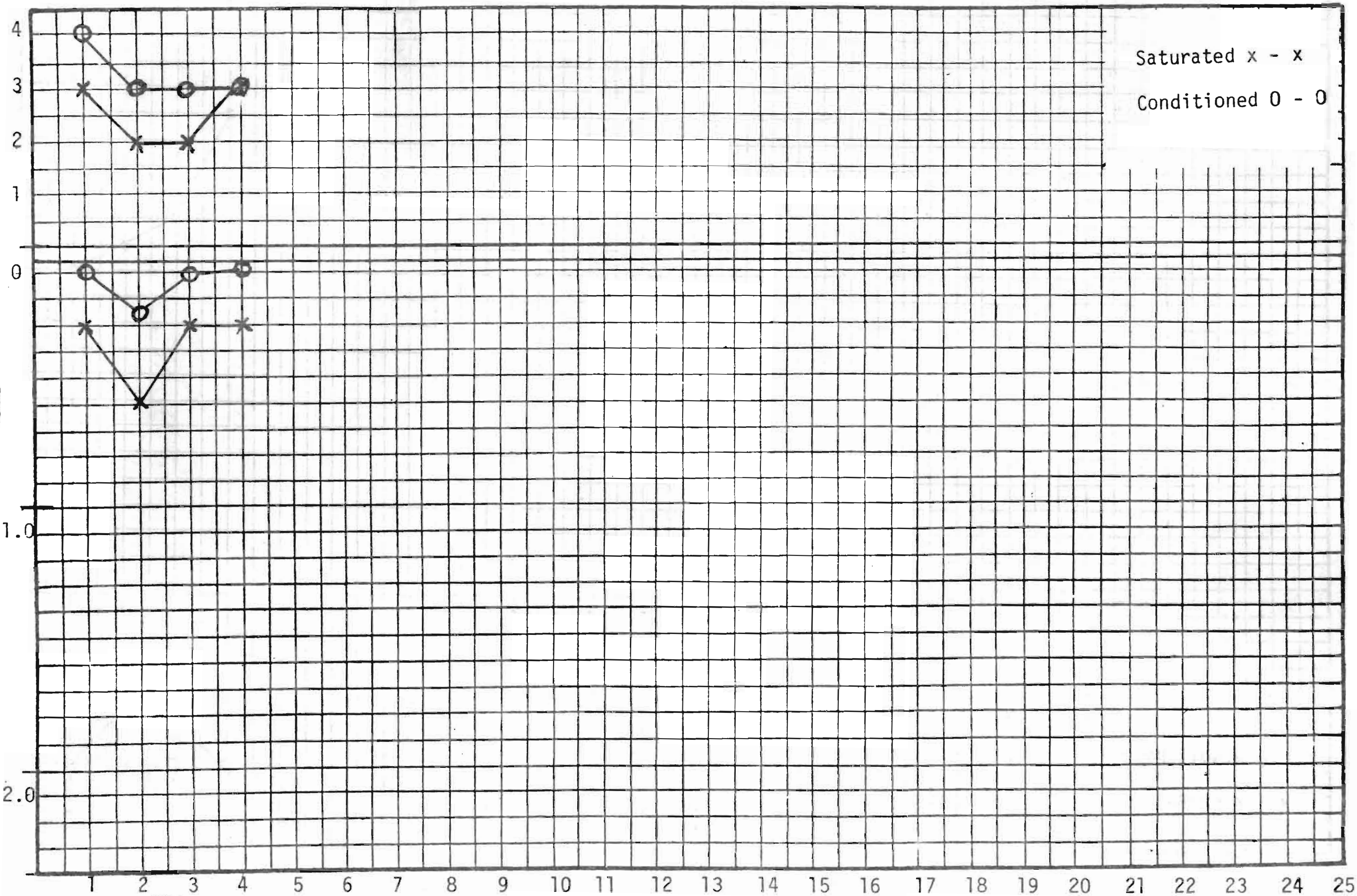


COALSTRIP - LAME DEER

TEST Resilient Modulus

STATE HIGHWAY COMMISSION OF MONTANA

SOURCE 5



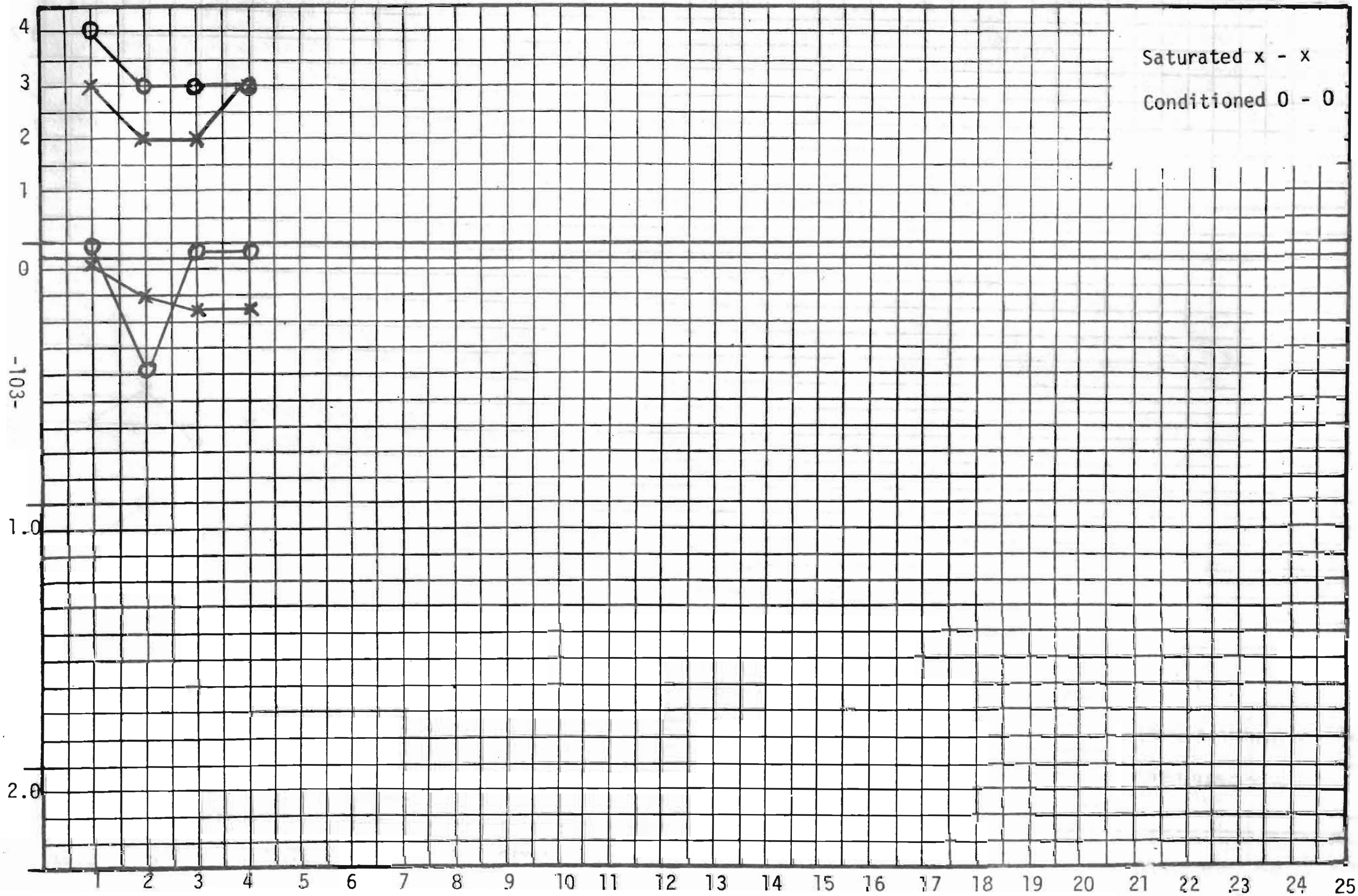
FORM 66

COALSTRIP - LAME DEER

TEST "E" MODULUS

STATE HIGHWAY COMMISSION OF MONTANA

SOURCE 5



COALSTRIP - LAME DEER

TEST MAXIMUM TENSILE STRESS — STATE HIGHWAY COMMISSION OF MONTANA — SOURCE 5